V R

CONFERENCE

ON

EDUCATION

ΥΓΙΕΙΑ

1884

LONDON.

WILLIAM CLOWES & SONS, LIMITED.

Intl. International Health Exhibition.
LONDON, 1884.

35-131

THE

HEALTH EXHIBITION LITERATURE.

VOLUME XIV.

CONFERENCE ON EDUCATION

SECTION B.

TECHNICAL TEACHING.
SUBSIDIARY AIDS TO INSTRUCTION.
THRIFT IN SCHOOLS.

PRINTED AND PUBLISHED FOR THE
Executive Council of the International Health Exhibiti
and for the Council of the Society of Arts,
BY
WILLIAM CLOWES AND SONS, LIMITED
INTERNATIONAL HEALTH EXHIBITION,
AND 13, CHARING CROSS, S.W.
1884.

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
STAMFORD STREET AND CHARING CROSS.

COMMITTEE OF ORGANISATION.

The Lord REAY (*Chairman*).	PHILIP MAGNUS.
B. ST. JOHN ACKERS.	Rev. JAMES H. RIGG, D.D.
The Ven. Archdeacon EMERY.	Rev. T. W. SHARPE.
J. G. FITCH.	The Hon. E. L. STANLEY, M.P.
Rev. THOMAS GRAHAM, D.D.	FRANCIS STORR.

RICHARD COWPER, *Secretary*.

VICE-CHAIRMEN OF SECTIONS.

A.—Rev. T. GRAHAM, D.D.
J. G. FITCH.

B.—PHILIP MAGNUS.
B. ST. J. ACKERS.

C.—Sir GEORGE YOUNG, Bart.
F. STORR.

D.—Hon. E. LYULPH STANLEY, M.P.
Rev. J. H. RIGG, D.D.

HONORARY SECRETARIES OF SECTIONS.

A.—W. SEVERN.
B.—E. M. DIXON.
C.—W. R. BOURKE.
D.—C. R. HODGSON.

FOREIGN DELEGATES.

AUSTRIA-HUNGARY.

Herr J. SOYKA, Professor in the University of Prague.
Dr. LUDWIG MARKUSOVSKY.

BELGIUM.

Mons. AUGUSTE COUVREUR.
Mons. BULS, Burgomaster of Brussels, ex-President of the Education League.
Mons. LEQUARRÉ, Professor in the University of Liége.
*Mons. GILLEKENS, Director of the School of Horticulture at Vilvorde.
*Mons. LANDA, Professor of Music in the Schools of the Town of Brussels.
*Mons. GERMAIN, Director of Primary Education.
*Mons. JOTTRAND.
*Mons. DE BOSSCHÈRE, Training College, Lierre.

BRAZIL.

His Excellency the Baron de PENEDO.
Dr. ALCOFORADO.
C. E. GIRARDOT, Esq.

DENMARK.

Professor STEEN.

FRANCE.

Representing the Ministy of Public Instruction.

Mons. A. DUMONT, Member of the Institute, Director of Higher Education.
Mons. BONET-MAURY, D.D., Professor of Theology in the Protestant Faculty of Paris.
Mons. LIARD, Rector of the Academy of Caen.
Mons. EAST, Inspector of the Academy at Perigueux.
Mons. BUISSON, Director of Primary Education.
Madame DILLON, Inspector-General.

Representing the Municipal Council of Paris.

Mons. A. DESMOULINS.

* These Delegates were unable to attend the meetings of the Conference, but contributed papers.

FRANCE—*continued.*

Representing the Société d'Enseignement Supérieur.

Mons. B. Buisson.

Mons. Arsène Darmesteter, Professor in the Faculty of Arts.

GERMANY.

Baden.

Dr. von Sallwürk, Oberschulrath.

Saxe-Weimar.

Dr. Stoy, University of Jena.

ITALY.

Professor C. F. Coscia, Rome.

JAPAN.

K. Nagai, Esq., Secretary of the Home Department, Japan.

S. Tegima, Esq., Director of the Education Museum, Tokio.

J. Murai, Esq., Member of the Tokio Sanitary and Pharmaceutical Laboratory.

NETHERLANDS.

Dr. J. Bosscha, Professor and Director of the Polytechnic School at Delft.

NORWAY.

Dr. G. E. Bentzen.

RUSSIA.

Councillor Machin.

SPAIN.

Señor M. B. Cossio, Director of the Education Museum, Madrid.

Señor F. Giner de los Rios.

Señor S. H. Capper.

SWITZERLAND.

Mons. Landolt, Inspector of Secondary Schools in the Canton of Berne.

UNITED STATES OF AMERICA.

Major-General John Eaton, Commissioner of Education.

Miss Dr. Freeman, President of Wellesley College.

Prof. C. M. Woodward, Manual Training College, S. Louis.

SECTION A.—VOLUME XIII.

SECTION B.—VOLUME XIV.

SECTION C.—VOLUME XV.

SECTION D.—VOLUME XVI.

SECTION B.

TECHNICAL TEACHING.

a. SCIENCE.
b. ART.
c. HANDICRAFTS.
d. AGRICULTURE.
e. DOMESTIC ECONOMY.

SUBSIDIARY AIDS TO INSTRUCTION.

THRIFT IN SCHOOLS.

CONTENTS.

SECTION B.

TECHNICAL TEACHING—SCIENCE, ART, HANDICRAFTS, AGRICULTURE, DOMESTIC ECONOMY.

SECTION B.

TECHNICAL TEACHING.

MONDAY, AUGUST 4, 2 P.M.

Chairman: The Right Hon. A. J. MUNDELLA, M.P.

THE CHAIRMAN said he must, before calling on Mr. Magnus to deliver the opening address, offer an apology for taking the chair, not being the Chairman of either Section; but he did so, on the invitation of the Council, simply while Mr. Magnus gave his address. It gave him the greatest pleasure to do anything which showed the appreciation of the Education Department of the work in which Mr. Magnus had been engaged. During the last three years he had been serving on the Royal Commission on Technical Instruction, and, with his colleagues, had rendered most able and gratuitous services to the country, and had made the most complete educational report which had been presented since the days of the School Inquiry Commission. To those who had not taken the trouble to master that report he would commend it most strongly, for it furnished the most complete account of the educational, he had almost said the social and industrial, condition of the nations of Europe which had ever been presented to Parliament. Its recommendations, which were very large, would involve a very serious responsibility on the Education Department and on Parliament, and it was

because he wished to recognise to the best of his ability the great services which Mr. Magnus and his fellow Commissioners had rendered that he came to preside on this occasion, and to listen to the introductory address, on perhaps, the most important Section of the work of the Conference, which he would now ask him to deliver.

PROBLEMS IN TECHNICAL EDUCATION.

By PHILIP MAGNUS.

THE subjects to be brought under the notice of this section of the Congress are very numerous, and include the consideration of some of the still unsettled problems of technical education. In the introductory remarks, which I propose to offer, I shall endeavour to indicate the advance that has already been made in the discussion of this subject, and shall refer very briefly to some problems which are still awaiting solution.

The Royal Commissioners on Technical Instruction have given, in their report, a review of what is being done in the matter of technical education in the principal countries of Europe, and incidentally they have directed attention to those parts of the subject which are still imperfectly understood. On several important questions which are viewed differently in different countries, they have collected the opinions of various eminent persons, and they have thought it wise in many cases to abstain from drawing any definite conclusions, feeling that experience alone can show the system of education which is best adapted to the various grades of persons engaged in industry in this country. Although, in some walks of life, for example in medicine, in engineering, in military and naval warfare, and in law, more or less systematic technical instruction has been given for

many years to those preparing for those pursuits, the technical education of artisans proper, as well as of persons engaged in our manufacturing industries, has, until very recently, received little attention. During the last few years, however, no educational topic has been brought more prominently before the public, and the progress that has been made, not only in the discovery of correct methods, but also in the establishment of schools in which those methods are illustrated, has been very great. The action of the City Guilds, and the investigations of the Royal Commissioners, have effected much in both these directions, and there can be no doubt that the City Guilds Institute and other bodies, who are now giving effect to schemes for technical education, have been much benefited in the preparation of these schemes by the results of the enquiries in which the Commissioners have been engaged.

Among the conclusions which may be said to have been established may certainly be ranked the proposition that all technical education must rest on a basis of sound primary instruction, and that technical teaching can avail little where primary instruction has been neglected. One of the first problems, therefore, which the technical educator has to consider is the character of the education to be given in our public elementary schools, in which nearly the whole of our artisans and labouring population receive their instruction. Whilst all educationalists have agreed that reading, writing and reckoning are the main subjects to be taught in every primary school, the enquiry into the conditions favourable for technical teaching have shown the equal necessity of including drawing among the obligatory subjects of instruction. Instances are continually coming under my own notice of artisans who are unable to take advantage of technical instruction through their want of skill in drawing; and by drawing I understand not only the power of sketching, but likewise linear drawing and drawing to scale. It is possibly not generally known to how limited an extent drawing is as yet taught in our elementary schools. In the year 1882, out of 18,289 schools

in England and Wales under inspection, drawing was taught in not more than 4293, and out of 2,875,003 children, between the ages of seven and thirteen, receiving instruction in these schools, drawing was taught to no more than 751,275. The figures for 1883 are not more satisfactory. It appears, therefore, that there are at present more than 2,000,000 children, or at least 74 per cent. of those who are being taught in State-aided schools who do not receive any instruction whatever in that one subject, which is generally regarded in every country of Europe, as well as in the United States, as lying at the basis of technical education. When it is remembered that drawing is taught in all the Board Schools of London, it will be seen that the percentage of children in other schools, not learning drawing, is still greater than that represented by the figures which I have quoted. To the disadvantages under which the majority of our artisans labour through having received no instruction in drawing, the Institute's examiners in technology year after year call especial attention. In the Report issued this year, the examiners are unanimous in bewailing the inability of the candidates under examination to make intelligible sketches. It is to be very much hoped that the Legislature will soon give effect to the recommendation of the Commissioners on this subject.

As regards the methods of teaching drawing, in order to obtain the most serviceable results in the shortest time, there is room for considerable improvement, and I am glad to find that papers are to be read on this subject by gentlemen whose views are entitled to be received with attention and consideration. Another proposition which may be regarded as already settled, is that technical education in all its stages involves the practical teaching of the principles of science. In the earlier stages of science teaching, this knowledge may be imparted by familiarising the pupil with the forms and properties of external things by means of object lessons, to be given in the Kindergarten or in the primary school. In its latter stages, it means the development of the faculties by bringing them into direct

relation with the processes of nature, in the investigation, in the chemical, physical, or mechanical laboratory, of the causes of known phenomena and of the effects of new combinations of known causes. The discussions already held on the subject of technical education, and the researches that have been made into the methods of instruction in Europe and America, have done much towards showing that a literary training is not the best preparation for the pursuits in which a large proportion of the population, including all the labouring classes, are now engaged; and that, in so far as this training is still employed, as the mental discipline of those who are likely to be engaged in handicraft or manufacturing industry, it is the survival of a method well enough adapted at one time to those who alone received education, but unintentionally extended to other classes, who, on account of the difference of their pursuits, require a totally different system of education. The necessity of science instruction for those who are to be employed in any kind of manufacturing industries, as well as for those who are occupied in any of the constructive arts, is now a settled point in technical education; but this being granted, there are several problems connected with the methods of science teaching still requiring solution. With respect to this subject, the discussions of the last few years have shown that science teaching, in order to become a useful discipline and to impart a useful power, must be far more practical than it has hitherto been—that the pupil must be brought not only face to face with nature, but into hand-to-hand contact with her processes, and that instead of assuming data for mathemathical investigations, these data and constants must be determined by himself in the course of his ordinary work. Attention will be drawn to these and other cognate matters in the papers to be read before this section.

The importance of a knowledge of foreign languages, particularly of French and German, is daily becoming more recognised as a part of the educational equipment of the technical student; and here, again, the consideration of

the kind of knowledge which the technical student requires is exercising, and is likely to exercise still more in the future, a great influence upon the methods of teaching adopted in our schools. To teach French and German by the same methods as have been employed for centuries in teaching Latin and Greek is now generally regarded as incorrect; and the necessities of the technical student will doubtless, in course of time, result in such a change of system as shall enable a boy at the close of his school career to speak and read a foreign language with tolerable ease, and thus to become conversant with what is said and written in other countries than his own, although he may fail to answer examination questions on the subtle grammatical distinctions now generally taught in schools.

Among the numerous questions bearing on technical education that are still open to discussion, and to some few of which only I can now refer, is the relation of workshop practice to the general instruction that should be given in the several grades of technical schools.

In our preliminary report on primary education in France, we threw out the suggestion that it might be advisable to try the experiment of introducing manual work into some of the elementary schools of this country; and experience of the working of the French and Belgian schools induced us to go a step further in our second report, and to recommend for adoption what we had previously suggested as an experiment. The question, however, is one on which wide differences of opinion still exist. In Paris and in some of the other cities of France, workshops have been introduced into elementary schools with what are considered very satisfactory results; and the experiment tried in France has been imitated in Belgium; whilst for some years past the Ambacht Schools of Holland have proved of the greatest value in the education of workpeople. In Germany, however, the same development of workshop practice in ordinary schools does not exist. In the elementary schools drawing is generally well taught; but, beyond that, there is very little of what may

be called practical teaching in the general school curriculum. In several of the Real schools the number of boys who work in the chemical laboratory is comparatively small, and anything approaching the experimental method of teaching physics is almost unknown. Speaking of this to an eminent German chemist, I was told *die Praxis kommt bald genug*, and this view is very general among German educationalists. The introduction of workshops into elementary schools is regarded as *Unsinn*, and complaints are made that with the longer hours that prevail in Germany, there is still very insufficient time to give sound instruction in the necessary elements of primary education.

Whilst a number of details as to the age at which manual work in schools should be commenced, as to the class of teachers who should be employed, and as to the character of the work that should be encouraged have yet to be settled, before any authoritative scheme can be laid before the public, it may be taken for granted that in all large towns where workshops are introduced into elementary schools the instruction should be rather disciplinary than professional, and should have for its object not the teaching of a trade, but the imparting to the pupil a general knowledge of, and familiarity with, the use of such tools as are required in almost every kind of work in which the pupil may afterwards be engaged. In districts where encouragement is needed for developing home industries, it may be desirable to specialise the workshop teaching at an early age; but, considering the difficulties which the complete mastery of the three R's and of drawing presents, I believe that if workshop training be introduced into our elementary schools it should not be begun before the pupil enters the fifth standard, and should be developed in the higher elementary rather than in the lower schools.

Intimately connected with the question of manual work in schools is the more difficult problem on which the greatest differences of opinion exist, that of the value of what are known as apprenticeship or trade schools. The

apprenticeship school is one in which the pupils are trained with the view to certain trades, or in which a definite trade is taught, whilst the general education of the pupil is continued. As will be seen from the Report of the Commissioners, such schools exist in large numbers in France and in Austria, and are beginning to be established in North Germany. Well-known examples of such schools are the École des Apprentis, at Paris, and a similar school at Havre. These schools have for their object the complete training and equipment of workmen. Pupils leaving the school are competent at once to gain a living as locksmiths, engine-fitters, pattern-makers, philosophical instrument makers, &c., and can earn wages varying from *2s. 6d.* to *5s.* per day. Instruction of this kind is further developed, in France, in such schools as the Écoles des Arts et Métiers, at Châlons, Aix, and Angers, in which foremen are trained, and in which steam engines and other machines are made for sale. At the time of our visit to the school at Châlons we found 150 students being trained as fitters, 25 as founders, 41 as smiths, and 74 as pattern-makers. A somewhat similar school exists at Komotau, in Bohemia, in which the pupils work five hours daily in the shops, and in which machines of various kinds are constructed. The Fachschulen of Germany and Austria come under the same class.

No school similar in character to these, of which examples are found in France, Austria, Germany, Russia, and in the United States, has as yet been established in this country; and the Commissioners, judging from what they saw abroad, and from the evidence they gathered on the subject, have not been able to recommend the establishment of such schools in this country. It is quite certain that for the training of workmen who are to be employed in large factories in which machinery of the newest type must be used, in order that the factory may be commercially successful, such schools are of little value. "On the other hand," the Commissioners admit "that in such schools, the students have an opportunity of learning different processes more speedily, under the direction of

foremen who are specially provided to give instruction, than they would do in the ordinary workshop, in which each man is put to that work which he is capable of doing most efficiently in the interests of the concern." There are many trades in which the workmen employed are not required to use machinery on a large scale. In the training of smiths and carpenters, and of those to be employed in small industries, it is an open question whether the trade school may not be the better means of rearing intelligent workmen than the haphazard rule of thumb system of the ordinary workshop, in which the apprentice receives no systematic instruction whatever, but picks up from what he sees and from those with whom he comes in contact, such information as he can. In those quarters of large towns which are thickly populated with labourers and artizans, as for example in the neighbourhood of Bethnal Green, a school for the technical education of boys who are to become mechanics or workmen in some of the various branches of the building trade might, I am inclined to think, be started with very good results. The boys would be received into such a school after having passed the fifth standard of the elementary schools, and would work as half-timers, continuing their ordinary education, supplemented by science teaching during part of the day, and working the rest of the time in shops under competent instructors.

The results at which we may be said to have arrived with respect to apprenticeship schools are rather negative than positive, and show that for the training of workmen or foremen who are employed in industries in which machinery is largely used, there is no school like the factory or workshop; and we have still to ascertain the trades, if any, for which apprenticeship schools provide the best system of instruction, and this question is one to which, in view of the development of these and similar schools on the Continent, public attention may with advantage be directed. In the training of young persons of either sex for art industries in the exercise of which machinery is very slightly used, the apprenticeship or trade school possesses certain distinct

advantages. For decorative artists, wood carvers, wood engravers, chromo-lithographists, glass stainers, and designers for different trades, the system of instruction as pursued in the Fachschulen and applied Art schools of the continent has much to recommend it.

In order, however, that these schools may be successful, it is necessary that the more advanced pupils should be employed in assisting in the production of saleable goods, and that they should be brought into direct contact with the commercial aspect of the work in which they are engaged. This fact introduces new difficulties in the way of establishing and of successfully carrying on schools of this kind, which have to be carefully considered, but which have not yet been successfully overcome.

Passing away from the consideration of this question, which may be regarded as still unsettled, I desire to point out certain difficulties which have arisen in the organisation of schemes for the evening instruction of artizans who are engaged during the day time in the factory or workshop.

Except in certain subjects, such as building construction, machine drawing, and naval architecture, the teaching paid for and encouraged by the State under the direction of the Science and Art Department, is rightly and necessarily that of pure science; whilst the teaching of the application of science to the particular industries in which the students are engaged, which is generally known as technical teaching, is under the direction of the City and Guilds of London Institute. The experience gained in the administration of evening classes in technology has shown me that a large number of candidates who are desirous of receiving instruction in the principles of science, in their application to the trades in which they are engaged, and who present themselves for the Institute's Examinations, do not attend the classes under the Department, and that many of those who are engaged in manufacturing industry, and who profit by the classes under the Department do so through the pressure put upon them by the Institute, which refuses to give them a full certificate until they have passed exami-

nations in certain qualifying science subjects. Under these circumstances, the question arises whether the instruction to be given to workmen and foremen in the principles of mechanics, of physics, and of chemistry, might be so varied as to form a more fitting introduction than seems to be at present the case, to the subsequent instruction in technology which those persons are eager to receive. It is, indeed, an educational question of some difficulty and importance, whether the same curriculum of science teaching which is best adapted to boys at Higher Elementary and Middle Class Schools, on the results of which the Department pays grants, is equally adapted to the instruction of adult workmen who have already obtained by experience a practical acquaintance with the machinery they use and the processes in which they are engaged. Whether any means can be adopted, to give greater inducements than seem at present to exist to artisans to undergo systematic study in the principles of science, in view of the application of these principles to special industries, is a question of some importance which must occupy increasing attention.

Among the difficulties in arranging special courses of technical instruction for artisans are the extreme division of labour and the numerous branches into which each trade is subdivided. Printing, coachbuilding, watchmaking are the names not of one industry but of several; and the technical educator is met at once by the question whether it is desirable, even if practicable, to arrange courses of instruction for those engaged in these separate divisions of the same trade. In the school at Châlons, to which I have already referred, greater specialisation has only recently been introduced into the student's work. It is, as everyone knows, only in a very limited department of a trade that a workman can ever expect to be proficient, and it is a question whether it is necessary to widen the sphere of the artizan's knowledge by showing him the relation of his particular work to the entire industry in which he is connected. It must be at once conceded that this wider instruction may not make a man a more qualified

workman, although by teaching him to think, and by educating him through his trade, he may thereby become more generally intelligent and competent. At the same time, there can be no doubt that in the selection of foremen and overseers from workmen, a preference would be given to men who had made themselves generally conversant with other branches of their trade than the one in which they are engaged. It is one of the principal functions of a technical school to give this wider and more comprehensive training.

In the teaching of industrial art we may be said to be still groping our way, and to have arrived at no very definite conclusions.

We cannot point to any country in Europe in which the problem which we are trying to solve at home has found a thoroughly satisfactory solution. The problems of industrial art teaching involve the consideration of the best training for the trade designer, the decorative artist, and the industrial artist; also the particular stage in the art-training of a student at which his work should be specialised with the view (1) to the trade for which he is to design; (2) the material in which he is to work.

If a person is to be trained as a wood-engraver, as a glass-stainer, as a metal-worker, what is the best education he can receive? If a person is to be trained to make designs for weaving, for calico-printing, for pottery and porcelain, for lace, for wall papers, what special instruction should he receive, and to what extent should his art-teaching be influenced by the trade or occupation in which he is to be engaged? It is very well known that a design may be beautiful in itself, but not adapted to the material in which it is to be worked. The capabilities of the material have to be considered as well as the mechanical appliances by which the design can be therein produced. The designer, therefore, must be something more than an artist, and the question arises, how and where can he best obtain this additional knowledge? Strange to say, in France, from the capital of which country designs for all

kinds of materials and fabrics, until very recently were almost exclusively, and even now are very frequently purchased, industrial art teaching is very little taught. Men are trained to be artists rather than designers. In Germany, on the other hand, there are several palatial schools of applied art, in which drawing and painting are taught with reference to special industries. If we were to infer therefrom that no special teaching is needed for the industrial artist we should probably make a grave mistake, because we should have drawn our inference without considering other factors in the problem, which distinguish France from Germany as regards the conditions of art training. There is another question of some importance to which no very definite answer has yet been given, and that is the extent to which it is desirable that the designer and the worker should be united in the same person. In olden times the artist and the artizan were one. Should we be likely to get better work if these two classes were again united? In one important branch of industry, at least, the City and Guilds Institute is encouraging this union of qualifications by awarding its Honours Certificate in weaving to those only who prove by examination that they understand the construction of the loom and the principles of weaving, and who show that they can both design and weave in suitable material an original pattern. It appears to me that this is an experiment in the right direction; but the science of technical education is still in its empirical stage; and it is only by observation, by experiments such as these, and by discussions such as are to be held this week, that real progress in this important matter can be made. I am glad to find that a day is to be given to the discussion of the question of the teaching of art in its industrial aspect.

It must not be thought that in these few remarks I have exhausted the consideration or even the enumeration of the unsettled problems in Technical Education, which here, and in other parts of the world, are engaging the attention of men whose business it is to devote themselves

to this subject. In our report on Technical Instruction will be found a discussion of many of these problems to some only of which I have been able to refer in this short address. The question of higher technical instruction is still beset with difficulties. The Commissioners distinguish between the education of the capitalist at the head of large industrial works, and of managers of works or persons charged with the superintendence of technical details. In those careers in which "theoretical knowledge and scientific training are of preeminent importance, as in the case of the manufacturer of fine chemicals, or in that of the metallurgical chemist, or the electrical engineer, the higher technical instruction may with advantage be extended to the age of 21 and 22"; but it is contended that for the majority of persons to be engaged in industry, an early acquaintance with the factory is indispensable, and consequently that systematic college education should be completed at not later than 19 years of age. It is worthy of note that the City and Guilds Institute has already provided for the training of those two classes of persons by the establishment of the Finsbury Technical College and of the Central Institution. A matter of some difficulty, however, which has to be settled by the technical educator is the extent to which theory and practice should be combined in the education of these classes of persons. In Germany, in Switzerland and in France, except in chemistry, and to some extent in engineering, practical work enters but very little, into the higher technical instruction. Workshops for the use of students are not found in the École Centrale of Paris, nor in the majority of the Polytechnical schools of Germany. Here, in London, on the other hand, in the Institution in which we are now meeting, an attempt will be made to combine the highest scientific teaching with workshop practice.

Another question which is rapidly coming to the front, is the best preliminary education for the higher technical instruction. At present, all our first grade schools are classical. Even in those schools which have a modern

side, Latin is generally taught and occupies several hours a week of the pupil's time. Is Latin an essential part of the instruction to be given on the modern side of first grade secondary schools? Is it possible to secure all the intellectual advantages which are obtainable from the education given in such schools as Rugby, Marlborough, Clifton, and St. Paul's, from a curriculum consisting of mathematics and practical science, the English language and literature, French and German, geography, history, and drawing? Such a curriculum would, in my opinion, be the best preparation for the higher technical instruction; but in order that it may yield the same mental discipline and intellectual advantages which a boy may get at one of our first grade public schools under the alternative classical training, the masters who are to teach science must be men of the same cultivated order as those under whose direction our public schools are now placed. The professor of science must doff his professorial gown and become the practical schoolmaster, if our boys are to gain as much good from the teaching of science as they have hitherto obtained from a classical training.

I have thought it well, in these introductory remarks, to bring under your notice some of the problems which have to be solved, in order that technical education may advance in this country. We have now, happily, passed that stage in the history of the movement when general discourses on the advantages of technical education are what is most needed. We have now to grapple with the special problems of method and of organisation, which must be solved in order that our system may be good in itself and adapted to the wants and requirements of our own country. I have no doubt that the papers to be read in this section will form a valuable contribution to the study of this important subject, and that the discussion of these papers will help to remove some of the difficulties connected with the practical working of this great branch of education.

Sir THOMAS ACLAND, Bart., M.P., in moving a vote of thanks to the author, said that the paper opened up a great many very wide questions for discussion, and these would require a great deal of consideration and thought. They were deeply indebted to Mr. Magnus, not only for his paper, but for the time and self-sacrifice which he had bestowed upon the work of the Royal Commission, of which he was a prominent member.

Dr. GLADSTONE seconded the vote of thanks. He trusted that the report of the Commissioners would be studied by all those who were in the room. He could not agree with the statement that the time was past for insisting upon the importance for technical education. He believed that there was still great need to so insist. If they compared the exhibits in the various parts of the Health Exhibition they would see the immense difference between English education and foreign education in this respect, and no greater service could be done than by such a discourse as that to which they had listened.

WORKSHOP INSTRUCTION IN TECHNICAL SCHOOLS.

By E. M. DIXON,
Allan Glen's Institution, Glasgow.

IN the present paper it is intended to summarise as briefly as possible the results of four years' experience in workshop instruction in connection with the Allan Glen's Institution, Glasgow; and, in order that this experience may be correctly judged of in relation to the experience of other technical schools, it will be necessary to state at the outset what is the aim of the institution in question.

This institution is organised so as to supply a suitable education to boys who are intended for mercantile or manufacturing pursuits until they attain to their sixteenth or seventeenth year. The scope of the teaching has been determined by considering the age at which lads belonging to the middle classes usually leave school to enter upon apprenticeships. Speaking for Glasgow, we may say that this age rarely exceeds sixteen or seventeen years; and that, in point of fact, it falls in the great majority of cases considerably below either of these limits. This statement, it may be remarked, is true not merely in families where the expense of educating lads to their sixteenth year is somewhat beyond their means, but it is also true in very many cases where the expense of education is not a matter of much consideration, but either where the education that a school can supply to a lad of sixteen is believed to be less valuable than the practical education he acquires at that age in the office or in the workshop, or where the parent's authority is insufficient to keep the boy at school.

The scope of the instruction being determined by the age at which pupils leave school to begin apprenticeships, the subjects of that instruction have in like manner been fixed, by considering that the object of the school is to prepare lads for learning thoroughly trades that have a mechanical or chemical basis, and this, too, in view of the fact that, as apprenticeships generally exist at present, the actual workshop must be regarded as a very defective teaching institution. It had also to be kept in mind that technical instruction must be preceded by, and indeed as far as possible accompanied by, a thorough course of education in English and other subjects that belong to a liberal and general education.

Guided by these considerations, it was evident that, in regard to what may be called the scientific and technical subjects, a school such as the one now in question must lay much stress upon mathematics, physics, chemistry, and drawing, and treat these subjects, at least in the earlier stages, as part of the curriculum of study of every pupil,

whether intended for industries of a mechancial or of a chemical nature. As it further seemed desirable to provide means for pupils to acquire something in the shape of really professional instruction in each of these directions, it became necessary to introduce specialisation of technical studies in the last year's course, and to give, in the direction of engineering on the one hand and of practical chemistry on the other, instruction of a character as real and practical as possible. It need scarcely be added that a chemical laboratory and a school-workshop are necessarily two of the class-rooms of an institution that was to be organised on these lines, and we have now to estimate, as accurately as possible, the results that have come from the teaching in one of these during the last four years, viz., the workshop.

In treating of this point it has to be noted that there has never been any intention of representing this school-workshop as competing with actual trade workshops, that is, as being able to turn out young men at least equal as regards skill in practical workmanship to others who have gone through an ordinary course of apprenticeship. On the question as to how far a school-workshop can, in the case of any trade, carry the training of young men in the special handicraft of that trade, no opinion needs, therefore, to be here expressed. The instruction hitherto given in the particular workshop now under consideration has not, indeed, been looked upon as principally valuable in the direction of manual skill. The attainment of a very considerable amount of skill has, in the case of many of the pupils, no doubt, been one result of the instruction they received, but such result has always been regarded as subordinate to the principal object of giving reality to the theoretical studies of the pupils. It may here, however, be said that our experience seems to have proved that lads of fifteen or sixteen can acquire in two years, during which they spend not more than one half-day weekly in the workshop, at least as much manual skill as is usually acquired by lads in the first two years of an ordinary apprenticeship. This statement, it may be added, is made

with a full consciousness of the charge that it implies of gross waste of the time of apprentices in the engineering trade. It must, however, be added, that there is no intention here of charging this waste of apprentices' time against the proprietors of engineering works. The want of suitable schools for preparing lads for engineering is the chief cause of the serious waste of time and talent that is going on. The proprietors will, no doubt, as such schools are multiplied, discover that lads can quite well be put into their hands with a considerable amount of skill in the handling of tools, with more or less ability to make and interpret mechanical drawings, and with some familiarity with those branches of science that underlie the mechanical arts. That they will by-and-by prefer lads so educated to other lads of inferior education is merely tantamount to saying that they will consult their own interest. The reflex effect of such preference upon the schools, and upon the public estimation of technical education, is obvious, and the tendency of the whole to raise the standard of skill prevailing in the engineering trade is no less evident.

Looking, then, upon the school-workshop as essentially the co-relative of the chemical laboratory, and having as its main function the illustration of the theoretical subjects that receive very nearly the whole of the pupils' attention, we have now to see for a little the part it plays in connection with one subject in which it is of the highest importance to the young engineer to be thoroughly grounded, and of which it is within the power of a technical school to give an excellent account, viz., mechanical drawing. I am induced to dwell somewhat upon this part of my subject by the fact that very recently some lads who have left the Allan Glen Institution, and entered engineering works, have been found, to the astonishment of the proprietors of these works, quite able to go at once into the drawing-offices, and to do work which, as a rule, only clever and persevering apprentices become able to do near the end of their apprenticeships. Our experience being that a systematic course of instruction in drawing, combined with

suitable workshop exercises is, in almost every case, capable of turning out a lad at sixteen years of age able to interpret and execute technical drawings of even considerable complication, it is desirable that practical men should know the fact as widely as possible, and also the means whereby it may be realised.

Instruction in drawing naturally commences with free-hand drawing, and that subject is regularly taught during five successive years to every pupil who goes through the full curriculum of the school. Such a pupil has had three years' instruction in free-hand drawing by the time he commences the study of mathematics—that is, on an average, when he is about thirteen years of age; and during the next two years he receives instruction, not only in free-hand drawing and mathematics, but also in drawing with instruments, in the elements of physics and of chemistry, and in the principles of theoretical mechanics. It is at the end of this time that the pupil is introduced to mechanical drawing and to a course of practical exercises in the workshop, and these subjects, with others that need not be specified at present, occupy the pupil for the two remaining years of his course of study. It should be added, however, that during these last two years the pupil also continues his study of practical solid geometry, in order that he may attain to a thorough grasp of that subject, as it forms, in fact, the foundation of all real knowledge of technical drawing under its various forms. In this way, the pupil who passes through the full curriculum has instruction for five years in free-hand drawing, for four years in practical plane and solid geometry, and for two years in machine drawing. In the workshop he also has instruction for two years in making models, patterns, or other articles in wood or metal from working drawings, and according to measurement. His exercises in machine drawing are also carefully graduated during his two years' course, so as to keep clearly before him at all times the relation of the object to the drawing or drawings of it, that he may be making. A pupil is never allowed to make a mere copy of a drawing, but he may

have to make a proper scale drawing from a rough-dimensioned sketch, or produce a drawing, or set of drawings, of a machine or a model, from measurements taken from it by himself, and in the last year of his course he may have to do exercises involving more or less original designing.

The exercises of the workshop operate, therefore, in training the pupil to see with his mind's eye the object in the drawing, that is to say, he there learns in the most real way the interpretation of mechanical drawings; and, when with skill in that direction there is conjoined on the other hand ability to draw, the qualifications of the mechanical draughtsman are supplied.

While the workshop supplies instruction of great value to the pupil in connection with mechanical drawing, there are other parts of his theoretical studies, however, that receive in it illustrations no less valuable. It is sufficient merely to mention such subjects as applied mechanics and the steam engine. There is, also, a considerable amount of very real and very useful knowledge of materials insensibly acquired through operating upon these with tools in various ways, and this knowledge being purely of an experimental nature, can be acquired in no other way than by means of workshop exercises. I believe, that in the case of many pupils in whom the faculty of abstract thought is but moderately developed, and by whom the theoretical subjects of instruction are consequently apt to be somewhat feebly grasped, the experiences of the workshop are, or may be, all-important in the way of throwing light upon results that the pupil fails to trace as deductions from more remote principles, but which he can, of course, accept as facts of direct experience. I am not sure that, even to the most subtle-minded, the manifold experience that a moderate amount of systematic workshop practice supplies, may not have a very beneficial effect in the way of securing perfect confidence in much of the theoretical instruction received in the lecture room; and I incline to think, moreover, that there is truth in the idea which is not unfrequently expressed when the engineers of this and of some of the

continental countries are contrasted, viz., that a man's action in practical matters is best and promptest when based very much upon his own experience. At all events, there can be no question that much experience along with much abstract thought is required to produce an accomplished engineer; and, apart altogether from the relation between experience and theory, a school that professes to supply the young engineer with theoretical instruction, must, simply to preserve the natural balance of his education, at the same time supply him with the means of obtaining in some measure the knowledge that can only come through his own experience. In other words, a workshop is a necessary part of a technical school.

From the above brief sketch it is evident that in the Allan Glen Institution pupils do not begin workshop practice until they reach, on the average, the age of fourteen or fifteen years. In a school organised, as this is, to carry on the education of its pupils till their sixteenth or seventeenth year, and under existing industrial conditions, I do not see that it is necessary or advisable to withdraw from the general literary education of the pupil or from his theoretical education in the principles of mathematics, physics, chemistry, and drawing, more than half-a-day per week for workshop practice during the last two years of his course. I think care should be taken that as little of the pupil's time should be spent in the workshop as is compatible with his receiving from it the necessary practical light it is capable of throwing upon his more abstract studies. We have to remember that time can be very readily wasted there through the spending of it upon work that could wait till the pupil entered upon his apprenticeship, and all the time needlessly spent in the workshop is just so much taken from the fund which, under the prevailing disposition to send boys prematurely to business, is only too small for equipping them with a satisfactory literary education before they leave school.

These remarks apply, of course, to a technical school of a special type. As to the efforts that are being made,

both at home and abroad, to introduce into elementary schools a greater or less amount of instruction in practical workmanship, I am unable to speak from experience, but I look upon that as being, educationally, a very different matter from workshop instruction in a secondary technical school. Again, going to the other extreme, we have some very excellent institutions, both at home and abroad, whose special function is to give systematic instruction in weaving, dyeing, and a few other trades. Here, again, the case is quite different from what exists in a school of the type at present under consideration. In such institutions the pupils are there solely, or almost solely, in order that they may learn the best modern methods of performing certain practical operations, and consequently these institutions presuppose an age and an education on the part of their pupils, that might be well found in pupils leaving a secondary technical school. The general name of technical school is, no doubt, applied to all such institutions, but this is not the only case in which nomenclature is a little misleading.

Finally, it may be well to state how the instruction in engineering, generally, is given in the Allan Glen's Institution. As principal teacher, we have a gentleman who held one of Sir Joseph Whitworth's scholarships for three years, and to whom is entrusted all the theoretical instruction, and the superintendence of the operations carried on in the workshop. In the workshop, again, an excellent workman, who is also able to prepare lecture diagrams, and otherwise occupy his time in school work when not engaged with pupils, is present during the school hours of every day. As pupils require a large amount of personal attention, it has been found to be impracticable, with one teacher, to send into the workshop more than about fifteen pupils at the same time, and hence classes exceeding that number have to be taught in relays. This, however, does not in actual operation cause any serious inconvenience. The larger tools, such as saws, planes, &c., belong to the institution, and each pupil has to provide himself with a box of

small tools that costs him about £1. The material at first employed by the pupils is wood, and so long as they are unable to work fairly well to measurement, the articles made by them are simple ones of their own selection, and become their own property upon payment of the material consumed. On the other hand, after a pupil has advanced to the point of being able to make a wooden model to scale, he begins to work for the institution, and regularly employs working drawings. He proceeds afterwards to work in metal, when, in the opinion of the principal teacher, he is able to take that step with advantage. As to the spirit with which boys go into their exercises in the workshop, I need merely say, it is what any person might anticipate who remembers the pleasure he had himself when young in working with tools of any kind, and as to the quality of the work that lads can be got to do under the circumstances which I have endeavoured in this short paper to explain, I will leave the exhibit of models from the Allan Glen Institution to speak.

ON THE VALUE OF SPECIAL AND GENERAL WORKSHOP INSTRUCTION IN ELEMENTARY, HIGHER AND EVENING SCHOOLS. THE EQUIPMENT OF SCHOOL WORKSHOPS.

By JOHN F. MOSS.

THE value of special and general workshop instruction in elementary, higher, and evening schools, will largely depend on the conditions under which it is given, the directness of its application to local requirements, and the aptitude of

the teachers employed to interest and guide the students in the courses most likely to be useful to them.

With regard to the conditions under which workshop instruction may profitably be introduced in connection with elementary schools, it will be difficult to lay down any hard and fast line. Every large public elementary school would be all the better for having a room fitted with benches and supplied with a few tools, so that elder scholars might be taught in their leisure hours how to use the saw and the plane, and thus to become more helpful and handy. But it would be hazardous to attempt any interference with the ordinary work of the school. The requirements are already full enough to tax the energies alike of teachers and taught, and, as a rule, work of this character can only be satisfactorily accomplished out of regular school hours.

The experiment has been tried, with some degree of success, of teaching boys at selected schools to make up simple articles of furniture, and a great amount of interest has been shown by the pupils. But to be of fullest value the school workshop should have a much wider aim than that of mere amusement, or even the teaching of young people to do a few useful things. It should supply a connecting link—practical in its bearing, and thoroughly educational in its character—between theoretical knowledge, as heretofore too exclusively relied upon, and the industrial pursuits in which such knowledge may be applied. It should be an integral part of the educational system, adapted to the requirements of industrial communities. It should be a means of illustrating scientific principles and of applying in practice theories which, of themselves, too often appear to the pupil as useless dry bones. The training of the hand and the eye should be immediately associated with the development of mental faculties. The practice in the workshop, then, should have a distinct and definite relation to the work of the school itself: one should work naturally into and help the other. The object will probably be most conveniently attained in connection with

higher elementary and other advanced schools. So far as public elementary schools are concerned, probably the graded schools, established in various parts of the country, will best answer the purpose. In populous centres there will be no difficulty in fixing upon one school, at least, in which the higher subjects of the code, and of the Science and Art Department's programme, may be more profitably taught than would be possible in schools where all the standards must be embraced, and the opportunity for teaching special subjects proportionately small.

An experiment in this direction with which I have been associated in Sheffield, has been carried out in connection with the Central Higher Board School. Here the ordinary work begins with the sixth standard—it did up to this year begin with the fifth standard—and some 600 pupils selected by examination from other public elementary schools have the opportunity given them of taking up drawing in its various branches, including geometrical drawing and machine drawing and construction, besides mathematics, mechanics, chemistry, magnetism and electricity, and other subjects, which, for reasons that need not here be dwelt upon, it would be impossible to teach with advantage in ordinary public elementary schools, without either involving excessive expenditure, or the neglect of other essential work.

Without wishing to magnify beyond its real value the importance of this experiment, I will attempt to describe its aim and success as the best means at command for illustrating the system of workshop instruction, which I venture to recommend to the notice of the Conference. The results of the experiment have so far been exceedingly gratifying, but more will have to be accomplished before anything like a perfect system is evolved. One important factor has yet to be supplied in the shape of the direct sanction, encouragement and aid of the Education Department.

What has been so far attempted may be briefly stated. Some ordinary workshop benches have been fitted with

simple appliances for working in wood and iron. Various local firms have gratuitously supplied excellent sets of tools, and the upper boys of the school are encouraged to come before the ordinary school hours and use them under the direction of the Science Master and a skilled mechanic. Only a small number of pupils can be accommodated at one time, but they gladly do the work without interfering with their regular course of study—in fact, admission to the workshop is accounted a high privilege—and there is no doubt that in many respects the privileged ones gain substantial advantages. Thus from geometrical drawing the pupils naturally turn to the shaping of correct geometrical forms in wood and iron, and it may be safely assumed that their workshop practice has been of immense value in increasing their appreciation of the subject in all its bearings. The thing assumes a reality which lines on paper and dry formulæ could not give. Mechanical drawing, too, is invested with greatly increased interest when in the workshop its language can be practically interpreted and exemplified. In this department of work Mr. Ripper, to whom I am indebted for much practical information upon the subject, has been singularly successful with boys even of twelve and thirteen years of age, but this success is undoubtedly attributable in a great measure to his own practical knowledge as distinct from the power alone of teaching drawing. Mere cleverness in drawing is of secondary importance as compared with a correct understanding of the principles of construction and the why and the wherefore of the parts delineated. Therefore, before pencil is put to paper, the pupil is required to clearly understand the uses and application of whatever portion of machinery is to be drawn. But how greatly must the value of this kind of instruction be enhanced when the pupil can afterwards proceed to the actual construction of working models. In Sheffield it has been impossible to attempt much model making, but such a scheme has been successfully carried out at the Allan Glen Institution in Glasgow, with the result that pupils, who have had the advantage of

workshop practice for not more than half a day a week, combined with theoretical training for three years, have been able to take their places in the machine-shops with apprentices of two years' standing. Here I must guard myself by explaining that the special instruction given at the Allan Glen Institution goes considerably beyond what can ordinarily be accomplished in connection with higher elementary board schools. There are, however, solid advantages to be obtained by the possession of a workshop in which considerably less is attempted—where the aim is general rather than special, and where the pupil gets not so much that which may be applicable in one particular line of work as that which will be serviceable in any.

The various forms of wood joints, the model structures and illustrations of mechanical principles worked out by the boys themselves at the bench and lathe (examples of which have been placed in the Exhibition) all have their direct uses, not merely in extending knowledge, but in investing it with an interest and giving it a reality which could not possibly be otherwise inspired.

Again, it may naturally be assumed that pupils in the ordinary drawing classes will apply themselves with increased zest, if, in addition to pencil and paper work, the opportunity is given them of doing a little modelling in clay, under judicious direction, or if they can have practice in the manipulation of light wrought iron-work, so as to form simple designs.

Add to these things the construction by the pupils themselves of simple apparatus illustrating the principles of mechanics, together with the free use of models of a more elaborate character showing strains and tensions, and you have nearly all that I would attempt in connection with the ordinary school workshop.

Thus the school workshop should embrace firstly, appliances for working in wood to such an extent as will enable the pupils not only to acquire a knowledge of various kinds of joints and principles of construction, but also to complete interesting specimens of work and gain

dexterity in the use of tools. Secondly, appliances for working in iron, including an inexpensive lathe and small forge. Thirdly, a room for modelling in clay, where pupils who show talent for drawing may be encouraged to develop their powers in a thoroughly practical direction. And, fourthly, a department of experimental mechanics where the pupils may practice with actual apparatus—partly made by themselves—such experiments as will illustrate the work done from their text books, in theoretical mechanics.

Some further details as to equipment and cost have been furnished by Mr. Ripper, and shall be appended to this paper, it being of course understood that the scheme should be altogether subject to modification and adaptation according to local circumstances.

It will be borne in mind that such a scheme of instruction as I have indicated does not contemplate any further development of manual skill and dexterity than would be useful in almost any occupation. The teaching of the trade must still be done in the regular workshop, but the apprentice will come to it better prepared. He will have a distinct notion of how his knowledge is to be applied, and also some degree of manipulative power which he could not otherwise have acquired. The previous development of physical as well as mental powers will render his course easier, and he will the more quickly learn any trade to which he may put his hand.

Those who are thus trained will start in the world with very distinct advantages; with grander conceptions of the dignity of labour, fuller appreciation of the duties of citizenship, and brighter prospects of useful careers than could possibly be theirs without such aid. One good moral effect has already become apparent: the boys account it more honourable to seek useful positions in the workshop than to hanker after clerkships, or what have been called more "genteel employments." And there is no doubt they may have better chances of promotion, for among such will probably be found many of

the foremen of the future, whose scientific knowledge will displace the old rule of thumb, increasing the productiveness of labour, and inducing a higher standard of excellence.

For ordinary evening schools the workshop instruction must necessarily be more limited than the course I have described, and it will probably not be found practicable to carry it further than a comparatively small amount of practice in woodwork. This remark has no reference to the work of technical institutions in which special trades are taught, or other advanced practical instruction is given. The apprentice or the workman who seeks to improve himself in the classes now alluded to, will not so much need instruction in workshop practice as in theoretical knowledge, which can be applied to his own particular branch of industry. He will have found out his deficiencies in this respect—deficiencies which will, it is hoped, be supplied to future generations of workers by such a scheme of instruction as is indicated in this paper—and the evening school should provide him with the means of placing himself abreast with his younger and more highly favoured competitors in business.

His requirements can, therefore, be readily met, if only properly qualified and sufficiently practical teachers can be induced to devote themselves to the work. At present, unfortunately, higher elementary evening schools are not nearly so successful generally as might be desired, and there is some difficulty in inducing teachers of power and experience to engage in them, notwithstanding the increased encouragement held out by the Education Department. But in most populous centres there are classes in connection with the Science and Art Department, which can be made available, and the only addition apart from the work of the Technical School proper that I would suggest would be the limited workshop instruction to which I have alluded.

I have not touched upon systems of technical and workshop instruction, so admirably carried out in connection

with our universities and technical institutions, as they do not fall within the scope of this discussion, but I cannot help expressing the hope in this connection, that the day is not far distant when England will outshine every other country in the thoroughness of its system of practical education for people of every condition in life. As one means to this end, I trust the desire so fitly expressed by the Royal Commissioners on Technical Instruction in the valuable reports recently published, to the effect that Government may be induced to grant its aid towards the department of work which it has been my lot more particularly to bring under your notice, may receive early fulfilment, and that the Congress itself may have influence in this direction.

APPENDIX.

As to the Equipment and Cost of a Small School Workshop.

[It should be noted that Mr. Ripper's scheme, though capable of general adaptation, may to some extent be considered as specially suitable for districts in which iron and steel industries predominate, and that for other localities greater prominence might be given to somewhat different lines of work.]

(1.) *Wood-work shop*, to accommodate about 12 boys, fitted with benches and ordinary wood working tools, to enable them to make such articles as the following :—

Samples of various kinds of wood-joints, small tool-chest, barrow, writing-desk, model door, cupboard, model staircase, model roof-trusses; also, if one or more wood-turning lathes could be furnished, many more interesting exercises might be attempted, such as tables with turned legs, book-shelves with turned supports, ladder, balusters, clothes-horse, towel rack, fancy articles, etc.

(2.) *Iron-work room*, to accommodate 12 boys, fitted with benches, 12 engineers' vices, hammers, chisels and files, grindstone, 2 or 3 smith's forges and anvils, hand drilling-machine, and, if possible, a small iron turning-lathe. A useful set of exercises might include: wrought-iron fire-screens, wrought-iron

model gates, model bridges, model roof-trusses, model crane; the filing up of plane surfaces, and of simple geometrical forms with accuracy.

(3.) *Clay-modelling room*, also to accommodate about 12 boys, and fitted with benches, modelling tools, and plaster casts.

By the above arrangement, a class of 36 boys spending, say, 4 or 6 months in each department, and working from an hour to an hour and a-half before or after ordinary school hours each day, or for, say, 3 or 4 hours on Saturdays, would obtain a highly useful practical training.

(4.) In addition to the above 3 rooms, another room to be set apart as an experimental mechanic's laboratory, and as a store-room in which to place the best specimens of workmanship from the workshops, models for machine drawing, &c.

The mechanical apparatus required is similar to that devised by the late Professor Willis of Cambridge, such as is now made by Mr. Rigg, of 11, Queen Victoria Street. The object of this apparatus is to enable a class of boys, under the direction of a teacher, to go through a series of simple quantitative experiments in the principles of mechanics, the boys themselves handling the actual apparatus.

A list of suitable experiments may be found in Professor Ball's book on Experimental Mechanics; also in Professor Perry's Practical Mechanics.

[Some sample experiments have been fitted up by Mr. Rigg for inspection in Room No. 14 of this Section of the Exhibition.]

The boys to be required to adapt, fit and bolt together, the various parts from a hand sketch of the arrangement in their own note books, and which has been previously explained in class. They are also to note down carefully the result of their experiments.

Approximate cost of tools, &c., required for the fitting up of an efficient school workshop to accommodate 24 boys working at one time, 12 at iron and 12 at wood:—

	£	s.	d.
Wood tools, 12 sets at 15/6 . . .	9	6	0
Iron tools, 12 sets at 27/- (including vice) .	16	4	0
A good collection of *wood* tools for *general* use for doing advanced work . .	30	0	0
Ditto, *iron* tools	30	0	0
Bench accommodation 24 (at 30/- per head)	36	0	0
	£121	10	0

The above does not include wood or iron-turning lathes, which would be most successfully used when driven by a steam or gas engine.

The tools may be used by any number of classes of 24 lads.

The cost of furnishing the clay modelling-room would be merely nominal.

DISCUSSION.

The CHAIRMAN (Mr. Mundella), alluding to the paper read by Mr. Dixon, said that they had heard a very modest paper by a very able Scotchman, who was doing excellent work in one of the best institutions of the country. Pupils who left the Allan Glen Institute were sought for on all hands, and they took positions which it was never supposed that boys could attain at such an early age. These pupils were becoming not only the non-commissioned officers, but the future captains of the industry of their country. It was for such purposes that technical education was required. In his own fashion Mr. Dixon had worked out a good technical school.

Mr. R. CLOUGH, in commencing a discussion upon the papers, said that he had not been able to detect any statement of the assistance which was rendered to technical education by manufacturers. He failed to see anywhere any indication of such assistance being rendered either to teachers or to students. As a practical teacher he had experienced difficulties through the want of such help. He had had successful classes under his control for a dozen years, but he had found a great deal of apathy on the part of manufacturers—the men who ought to come to the front. To his mind the question was not so much how to give technical education to students, as how to interest the employers, who would be directly benefited by such education. He was quite aware of the isolated cases of technical schools at Glasgow, Bradford, Leeds, and elsewhere,

but these afforded no criterion of the general technical education throughout the country. They had also to deal with agricultural interests, which was the greatest industry in the country, and as yet there was very little done. The farmers would not do anything, and they were afraid that anything should be done. They objected to provide money even for the elementary education of the day. He had visited many continental schools and seen what they were doing, and he should be glad to see something of the same kind done in England. In passing through the Exhibition he saw evidences on every hand of the absolute superiority of the English workman to the foreigner. They must get over the apathy of employers, but he did not know how to do it.

Mr. W. J. HARRISON (science demonstrator, Birmingham), said that he had heard of one Yorkshire manufacturer who paid £3600 a year to the School Board; so he might very well hope to receive some advantage from the education which was given without any more direct efforts on his own part. They required that technical teaching should be recognised as a specific subject. The work of teaching the manipulation of material and tools was extending, but there was no direct encouragement of it from the Education Department. He hoped that it might be made a specific subject, and grants be given for it. In the Birmingham Technical School for 7th Standard boys it was made a specific subject throughout the whole school.

The CHAIRMAN: At whose expense?

Mr. HARRISON said that it was done at the expense of the Chairman, Mr. George Dixon. He thought that the solution of the problem in towns would be to group five or six schools together according to their geographical position, and have a technical school with a workshop and laboratory for each group. As the children of the ordinary schools reached the higher standards they could be passed into the technical school. But then again the children would be required to stop at school longer for this purpose. It was a misfortune that at the present time the clever

children passed through the standards, and left school just as they were beginning to be a pleasure to the teachers. Again, the children were wanted at the evening schools, and he hoped that those schools would get some greater encouragement. Technical subjects should be taught at the evening schools. At present those schools were compelled to teach the elementary subjects, "the three R's"; and the bigger boys did not want to learn these.

The CHAIRMAN said that class subjects could be taught.

Mr. HARRISON said that they were not allowed to teach specific subjects separately at the evening schools. But, at all events, he should be glad to see a higher standard in the ordinary schools than now existed. The change was too abrupt from the elementary school to the science classes. If there was an eighth standard it would bridge over the interval between the day school and the science class, which was now far too great. It appeared that in the latest Code there was a discouragement to technical teaching, because boys who had passed the seventh standard could not be presented again.

The CHAIRMAN said that the speaker was under a mistake.

Mr. HARRISON said that a special application had to be made to the inspector. As to the technical teaching at Birmingham, the new workshops which they had opened at the Technical School there were crowded. They were attractive to boys, and the parents recognised the great advantage that would be derived from sacrificing a little to keep their boys at school another year.

The Rev. H. D. PEARSON said that the subject of the papers was of the utmost importance to them all as Englishmen, and it was of especial importance to those persons who were connected with school boards. One great danger of the School Board in London was that the boys looked forward to clerkships, as one of the papers had just stated. There was such a glut of applicants for clerkships that when, not long ago, a vacant clerkship of £150 a year was

advertised there were twelve hundred applicants for the place. There was a great deal of talk now-a-days about over-pressure, and there were persons who thought that the teaching of specific subjects and class subjects was bad in that respect. He contended that a reasonable variety of subjects was the best possible remedy for over-pressure. The teaching of the three R's, as they were called, only conduced to over-pressure, because of its monotonousness. In connection with his friend, Professor Gladstone, he had tried to get the introduction of the teaching of the use of tools into some of the ordinary elementary schools. The Kindergarten system was introduced among young children in order to give them greater pliancy of fingers. As they grew older the children should be taught to handle tools. When they were still older their fingers, as it were, stiffened, and it was then more difficult to teach them to use tools than it would be at an earlier age. Such instruction might be given to school children in a modest way without much expense.

Mr. D. CLARK recommended that the supervision of drawing should be placed under an inspector, and that the supervision should be carried out not only on the annual examination day, but at incidental visits. This would secure a uniform amount of attention throughout the whole school year. He should regard that as a very important step towards the improvement of technical education and the cultivation of taste in every branch of art. It had been questioned whether any amount of technical education should be given in public elementary schools at the present time. He believed that an insuperable obstacle to it existed in the present Code, in the conditions upon which the maximum grant was given. While it was necessary to pass every child in every subject in which he was examined in order to secure the maximum grant, the introduction of technical education would be impossible. If the maximum grant was given for 75 per cent. pass in the elementary subjects, the whole of the sharp children could be moved forward during the year

into higher standards, and they would be able to turn their attention to technical subjects at an earlier age. At present a child could pass only one standard each year. If a teacher could pass his sharp children through the six or seven standards in three or four years, there would be room left for the development of genius, and for the discovery and development of distinctive faculties. Under the present system genius was allowed to die out. If a child was ever so sharp or promising he was kept "dilly-dallying" away for six or seven years till he had passed the standards, and hence his genius lay dormant, and he became disgusted with every subject to which his attention was directed. If a teacher could allow his child to make whatever progress through the school he was capable of, the child would take delight in his work, and he would leave the school with an intense desire for future progress. As a public elementary teacher he appealed for the alteration he had indicated in the conditions on which the maximum grant was given. If that was made there would be a large amount of cultivation of genius in the public elementary schools.

The CHAIRMAN rose to order. He thought that the remarks which the speaker was making would be more suitable for the subject of Wednesday next, when elementary teaching was to be considered. The statements which Mr. Clark had made were singularly inaccurate in many respects. He (Mr. Mundella) would be in the chair at the discussion of the subject on Wednesday.

Dr. GLADSTONE said that he had listened with the greatest pleasure to the two papers on technical teaching. He was not unacquainted with the schools to which those papers related. Anyone who visited Room No. 14 in that building would see some of the fruits of the work of those institutions, and might observe that Great Britain had commenced to do that kind of work which hitherto had only been done with success by some other countries. He could only wish those two institutions the very great success which they deserved. The Allan Glen Institution was really a

technical school. The other institution which had been described took the children who were in the elementary schools, and fitted them for the great work of life on which they were to enter afterwards. That particular kind of school had hitherto been wanted; and he believed that it existed nowhere else. It appeared to him to be a great missing link in our educational establishments. They must bear in mind that education, as it now existed in this country, had been framed very much upon the traditions of the Middle Ages. There was, of course, a time at which the education was of a monastic character, and by it young people were trained up to be clergymen and lawyers, and professional men of every kind. It was at that time very natural that they should be taught rhetoric and logic, and literature of various kinds, and that, in fact, their education should be entirely literary. The knight or the soldier was at the same time drilled well in physical exercises, and in heraldry, and various other useful accomplishments. But we were now educating in our elementary schools not the professional classes, or knights, or soldiers, but our artizans and servants. They were those who were to do not the talking, but the work of life. That work was to be done not so much by their tongues, as by their eyes and hands; and what was now needed was that their education should be modified in the direction of the work which they would have to do. It did not follow by any means that the subjects which were best fitted three or four hundred years ago for the teaching of the clergy, or of barristers, were best suited for the teaching of artizans. Another thing to be considered was, that since the time of which he had been speaking, the whole inheritance of natural science had come upon us. We now understood nature in a way which was totally impossible a century ago; and we must not omit to introduce into our elementary schools instruction with regard to those forces of nature which would make people the slaves of the materials around them, if they did not become acquainted with those forces so as to be able to master them.

What was wanted was an education which should not be so much of a literary as of a scientific and material character. They wanted, of course, the literary element in it. But what was wanted, *par excellence*, was that which would fit the young people for the practical work of life. Let teachers endeavour to cultivate the higher faculties of the children, and make them good citizens by means of this more technical education, instead of by means of the education which possessed the traditional character to which he had referred. With regard, more especially, to technical schools, it appeared to him that what they needed to introduce was not the teaching of particular trades, but a kind of education which would enable the children to learn their trades easily when they had left school. They required a scientific training of their physical and mental faculties, and these might be well given from the very commencement of their school course. He was exceedingly glad that Mr. Mundella, and those who were associated with him in the Education Department, were introducing so much of the Kindergarten exercises into the training of small children, in order to develop their senses and their faculties. But it was needful that in the middle classes of the school elementary science should be taught, and that such arrangements should be made as would make it worth the teacher's while to take up elementary science. From the youngest classes up to the top classes of the school, a considerable amount of attention should be paid to nature and to the world around. If the instruction which he had described was given to the infants and to the boys and girls in the middle classes, it would be found that they would be better fitted for work in the higher classes when they reached them. Several members of the School Board were urgently taking the matter up. He hoped that when they came to deal with the higher standards they would be enabled to give instruction of a more technical character, such as the art of working in wood, and brass, and iron. He almost thought that such a subject might be taken np under the Code. He also hoped that the subject of

mechanics would meet with more favour. At present it was about the most difficult of all the specific subjects, and therefore it was scarcely taken up by any of the schools throughout the country. He thought that there were only about six of the Board Schools of London which took it up as a specific subject. Further, we needed in our schools in England more instruction in the different manufactures which were carried on in the districts in which the schools were situated. This sort of instruction was given to a greater extent on the continent, and it might be found magnificently illustrated in the exhibits from the school of the Christian Brothers, which were to be seen upstairs. In Clerkenwell, for instance, they could have illustrations of the clock-making industry of the neighbourhood; and the schools in Bermondsey could have illustrations of leather making. Then they should introduce modelling in clay, and instruction in form, not on paper merely, but form in sculpture of the three dimensions, and not of the two dimensions only. Then they might have workshops, such as had been already indicated, for the boys of the higher standards and for those who had just left school. They might be grouped from several schools, as had been suggested, in the same way as the girls were grouped in various centres for instruction in practical cookery. Or if that could not be done, at any rate there might very well be workshops in many of the large schools, such as he had seen in Paris and elsewhere on the Continent, in which simple instruction was given in the use of tools. In these workshops the boys would not learn a specific trade, but they would be fitted for those technical classes which he hoped would be established everywhere. As to evening classes, his friend, Mr. Harrison, was, of course, wrong in stating that they could not teach specific subjects in evening schools, but he was quite right in one point, and that was that those specific subjects could only be taught by teaching at the same time reading, writing, and arithmetic; and there were many young persons who considered themselves perfectly *au fait* in those matters, and therefore refused to

come to the evening classes, but if they might dispense with those subjects they would be glad to come and continue their education at the evening classes.

Mr. WILLIAM RIPPER (Sheffield) said he was glad to be able to reply to some of the remarks, made by Mr. Clark, of a rather pessimist character. He could only say that in the Sheffield Central Schools, if they had sufficient accommodation in the workshops, they could put in at least 200 boys who had passed all those subjects, which Mr. Clark contended it was not possible to pass them in. In Sheffield they had had some considerable time now to gain experience in the working of such schools and of the work which could be attempted, but in some quarters there was a little misapprehension as to what they were aiming at. For instance, he had had schoolmasters say to him, "It is all very well for you technical men to advocate technical instruction, because you are able to carry it out, but we have had no training which would render us able to carry out this work." He thought the scheme which Mr. Moss had done him the honour of reading, and which was drawn up at his request, could be carried out in any elementary school, even although the head master might not be possessed of much technical knowledge. It was proposed that skilled workmen should attend and give instruction in each branch of industry, one, for instance, teaching woodwork, another teaching ironwork; this would only be required for a few hours during every week, and would not cost in wages more than about 1*s.* per hour. Most probably the teacher of drawing would be able to give instruction in clay modelling. The workmen would be under the supervision of the head master of the school, who would see and approve of the syllabus of exercises. Perhaps the list read out by Mr. Moss might seem lengthy and detailed, but it must be remembered that a properly arranged system of exercises was really at the root of any efficient system of technical instruction. The head master would see that the approved syllabus was followed, although he would not necessarily himself be acquainted with the

practical operations connected with the work. There would be no more difficulty connected with practical instruction in workshop schools than in needlework schools under a mixed scheme. There should not on any account be any attempt made to teach special trades. This point had already been referred to by two or three speakers. He had known workmen bring forward all sorts of objections against these workshop schools, because they assumed that particular trades, such as engineering, were to be taught there; but when it was explained that the aim was to give general training which could not fail to be of advantage in any trade, the opposition had turned into considerable enthusiasm in favour of such training. Special trade instruction was not within the province of an ordinary school workshop, but belonged more properly to a technical institution. The longer he was connected with school workshops the more hopeful he was as to their future success in all large industrial centres. As time went on they would speak for themselves, and would not require papers to be read advocating their claims. All that was required was that the Education Department should give some substantial aid towards them. With regard to Mr. Magnus's paper he had been exceedingly interested in it as must all who had carefully thought about this matter. He said, "We have still to discover the trades which would be benefited by establishing apprenticeship schools"; and that was a matter of very considerable importance. In describing apprenticeship schools, whether in France, Belgium, or in England, or rather those which were most nearly allied to them, for there were no strictly apprenticeship schools in this country, the engineering seemed to be always the kind of school referred to. At Chalons and at other schools in France, engineering was principally taught, but from what information he had been able to get he did not think this system would be suitable for England. The manufacturer would say that the work turned out of an English workshop was superior to anything in the world. He could not improve the skill of the workman in using

his tools by sending him anywhere better than his own factory, and he thought in the best engineering colleges the professors distinctly kept away from anything like actual practice in the workshop. If gentlemen, like Professor Unwin or Professor Kennedy, would give their opinion on this subject, it would be of great value. There could be no doubt that those persons who had to do with teaching engineers in the evening found there was a great want of sound theoretical instruction on the part of their pupils, whilst their practical skill was of the very highest order, and he thought it would be unwise to encourage young engineers who spent the whole day in a factory to attend a workshop school in the evening. Just to mention one instance: he had attending his class in Sheffield a manager of large works, a man forty years of age, who had attended for a long time, and who recently sat in the Science and Art Department examination on "steam," and failed; and he believed if he were to sit half a dozen times he would probably fail. On the other hand he had young men, engineer apprentices, who had come to his classes, and who would be the first to go into a school workshop if it were open to them, but not having that opportunity they learned mechanical drawing, applied mechanics, &c., and he had met a former pupil of his in the Exhibition, who was now employed at one of the largest engineering works as draftsman. Probably if he had gone into school workshops instead of going into the lecture-room, he would not have reached the position he had now attained.

The CHAIRMAN (Mr. Mundella): As I shall have to leave the meeting now in order to attend to my Parliamentary duties, perhaps you will allow me to make just a few remarks before asking Mr. Magnus to take my place. I listened, as we all did, with great pleasure and enjoyment to the address of my friend, Mr. Magnus, who dealt practically with the whole question of technical education. There were one or two matters which he seemed to regard as open questions,

which I think ought to be regarded as settled; I refer first to the apprenticeship school. I have visited apprenticeship schools on the continent, and amongst others that admirable school on the Boulevard de la Villette, probably one of the best in Paris, and where I found 300 youths receiving a good education, not only in literature, but in languages and mathematics, which cannot fail to be very valuable. I found they spend about half their time in the workshop, and they were practically receiving an apprenticeship training up to the age of 16 or 17; but this was done at the cost of some £12 per head per annum to the Municipality, and the question that suggested itself to my mind was this: if these 300 youths are entitled to have £12 per head spent on them—and it was even being deliberated whether they should not give them their principal meal in the middle of the day—perhaps there might be another 200 or 300 in another boulevard; why should not the whole of the children of the artizan class in Paris have the same privileges. It seemed to me that the attempt was beyond the necessities of the case. I believe if you give them that practical good teaching to which Mr. Ripper has just referred, and then let them get the application of it in the workshop, you will turn out the best workmen in the world; and I think that was the general conclusion of the Royal Commissioners, of whom Mr. Magnus was a member. We have been dealing, I think, with two subjects this afternoon. The first paper dealt with technical training in a middle-class school, a really secondary school, because the Allan Glen Institute is an institution giving good secondary education in addition to giving that excellent technical instruction to which Mr. Dixon referred. Nothing can possibly be better than the connection of the two things, but it is not for our own artizan class that you want that class of instruction so much as for those who have become the managers and the foremen, and the guides and leaders in all the industrial workshops and mills throughout the country. There is a

singular defect in that respect. The Rev. Mr. Pearson spoke of 1200 applicants for a clerkship, and I remember a similar case in Manchester recently being called to my attention ; there were two advertisements, one for a clerk, and one for a foreman engineer ; for the clerkship there were more than 1700 applicants, but for the foreman engineer not one really available. That is the kind of test; every youth who can manage to pass the sixth standard is practically available for a clerkship, and it is a *dernier resort* for those who have no trade or profession, so that you will always have an immense number of that class to fill in everything else, especially in a country where you educate everybody, and they turn to clerkship as a means of living. But the great thing is to show to the working class the real dignity of labour as has been set forth in these papers, and to let them feel that it is a far nobler thing to be the head of an engineer's shop, or to be a first-rate joiner, or a good mason, than it is to be a poor clerk who has to contend against the frightful competition which exists in that class, and who must appear respectable on the narrowest possible means. When we come to the question of manual instruction in our public elementary schools, that is a subject with which I have a great deal of sympathy. I am sorry to say that whenever any new subject is suggested it is always remarked that you must have important aid from the Department. I think it is a very good thing that something should be done as is being done in Sheffield now, and that manufacturers themselves should take some interest, and find the appliances, and feel that they are aiding their own industries by having really properly trained workmen. I believe that that very school to which Mr. Ripper referred, which gets no grant for manual exercises—practically a self-supporting school—that they get such large grants from the Science and Art Departments that, notwithstanding they have the very best teachers they can find, it costs very little to the rates. Am I not right, Mr. Moss?

Mr. MOSS: Not quite, yet.

The CHAIRMAN: At any rate it costs a great deal less to the rates than some of the schools where the curriculum is of a very much lower class.

Mr. RIPPER: We expect in one year more it will be self-supporting.

The CHAIRMAN: There is one question that applies to the very root of all our difficulties. Mr. Harrison said, we want an eighth standard. Well, we have already got up to a seventh, and we very often have the seventh standard twice repeated. What we want is children who will remain at school after they have passed the fourth standard; we want a much higher ideal of national education altogether. At present we have some 8000 or 9000 parishes in England where the fourth standard is the standard of the total exemption of children who pass out of school at 10, 10½, and 11 years of age, and immediately begin to labour. So long as education is so little appreciated by the local authorities, and by the parents, while it is frowned upon as it often is, and, as a gentleman said to me, in some places it is detested altogether, you can hardly expect that the children will stay sufficiently long in school to get scientific or technical training. Mr. Magnus is quite right in saying that this kind of training ought not to begin until children have reached the fifth standard as the minimum. But what are the facts? The great mass pass out of the school before they reach the fifth standard. In Birmingham, Sheffield, and other large cities, a considerable number pass to the fifth and sixth, and rejoice that it should be so, but they are not representative of the great mass of the people in this country. What we want as the foundation of all technical teaching is a much higher standard of primary education. The children should stay much longer at school, and then, when you have got a higher standard of primary education, you may graft on that some better technical education. Mr. Clough said that manufacturers do not as yet appreciate technical training. I quite agree with him. I remember nearly twenty years ago, when I first mentioned the question in England, and told the

members of the Chambers of Commerce, and others, what I had seen going on in Germany in the polytechnic and trade schools, and the influence they were having on their industries, my statements were regarded almost with incredulity. The term technical education was unknown in England at that time. We have always had a great deal of teaching in our workshops, and I agree with Mr. Clough that the English working man is the very best in Europe; nothing can be better than the rapidity of eye and hand, and the power of application of the English workman, but we have neglected him very much, and we are now endeavouring, I hope, to make up somewhat for our past neglect. It was said by Dr. Gladstone that the subject of mechanics was not often taken up in the elementary schools, because the schedule was a little too stiff, and no doubt the teaching of mechanics is not so easy as some other subjects, but it is more a matter of the teacher than of the schedule, I think, and also of appliances. But as we get more and more enlightened School Boards, and a healthy public opinion, all these subjects will rapidly come to the front, and be dealt with. But I want to keep before my audience this fact, that what we need in England in order that any technical education may succeed is that the people should have a higher idea of education. We want more readiness to make sacrifices on the part of the parents, and of all concerned. We want more of the Scotch spirit amongst us, where the shepherd and the hind will work hard to keep his boy at school until he is 14 or 15, and then very often send him on to the university. A friend of mine said to me the other day, "My gamekeeper's sons have run my own lads very hard indeed at a particular university." We want more of that spirit in our people, more readiness on the part of parents to make sacrifices for their children, and a higher ideal in all our local authorities. I hope the day will soon come when we shall get rid of the fourth standard as the standard of total exemption for children for school attendance.

Mr. MAGNUS then took the chair.

The Rev. J. STARK said, as a Scottish schoolmaster and now a member of the School Board of a district close to Glasgow, he must say that their great difficulty was not so much in getting children to continue a considerable length of time at school—for they had had a very large proportion, in one case as high as 53½ per cent. in the fourth and upper standards—as in giving sufficient inducements to parents to keep them there as long as they would like. And the power of being able to dispense altogether with elementary education in the evening classes, and only teaching higher subjects was one which was of great importance to them. They had not the children, and had not had for years, to gain a sufficient elementary grant in the evening classes, and therefore as they could not without that grant carry on evening schools, it was very desirable that the present rule should be revised. They all knew in Scotland how particularly well fitted the Allan Glen Institution was for carrying on its work, but in ordinary board schools they had not the means of sending out the boys fitted at once to do something, however little, at their future business or trade. That was a point in which England was before them, and he trusted that when the time came to ask for some change in this respect it would be granted. What they needed in Scotland was to get some system, such as they had in Sheffield, adopted in each district in three or four of their very best Board Schools.

Sir THOMAS ACLAND said it appeared to him they had been discussing two entirely different questions,—one, the best material of general education, and the other how to carry on the instruction of young lads after their elementary education. One point that came out very strongly was that we were living in a time when we were beginning to learn the educational value of practical matters. When he was at college, some fifty years ago, the idea of the tutors

was that anything which could be of use to you in after life must be a bad instrument of mental training. Happily they had outlived that time, but they had also had some very practical and useful cautions from Mr. Magnus against supposing that the object of schools was to teach the business of life. Dr. Gladstone, however, had sketched out a syllabus which, on a very moderate computation, would require something like ten or fifteen years to go through; he started on the assumption of a very good general education, and then told them all the different subjects which might be taught. No doubt they might; but he spoke as a simple country gentleman who had to do with farmers and country labourers, and consider what they could learn, although he watched what went on in the town as well as he could. It seemed to him that in elementary schools they were too much in a vice; they wanted more men like Dean Dawes; he was not cramped by all the terrible rules and standards, but brought his knowledge of Euclid and common sense and knowledge of life to bear in every part of the school. They wanted schoolmasters to be competent to do this for one thing, and then, in the next place, that they should have liberty and freedom to do it. These two points had come out very clearly, that these practical matters might be made the means of education, but that schools must not assume to teach trades, and also that they wanted a little more freedom in the work of the school; but before they had that freedom they must have men so trained that they could make good use of it.

Mr. R. CLOUGH asked leave to supplement his former remarks by a few words. One of the main ideas which struck him had been that the view set forth with regard to technical instruction was that the artizan should become more refined, more capable of applying his knowledge to what he had to do in after life; but on referring to the papers and to the remarks made it would be found that the whole tendency of the discussion seemed to run in the direction of making boys good mechanics. There were plenty of good mechanics in England, but an inspection

of some of the pottery work from Stourbridge in the Exhibition would afford an example of another kind of technical training, which it seemed to him was sadly wanting, and that was a kind of training which could not be carried out by shear mechanical force; they wanted more artistic training, and the opportunity of inspecting really good works in museums and art galleries. Take, for instance, the case of wood carving, if there were in the schoolroom a case of high class objects of that kind, however small, containing only one or two good examples of various periods, that would materially assist any lad who cared to study wood carving. It would so far take him out of his ordinary groove, and bring him face to face with examples of the best periods. The same thing would apply to all kinds of metal work and pottery, and therefore he was rather surprised to find that there had been no reference to the artistic side of the question. He had had very large experience in teaching building construction, and his impression was that they were teaching too much of the mere bricks and mortar side of the question, and too little of architecture. If they were to compete with foreigners in this matter architecture must be studied as well as construction. Mr. Harrison seemed to have an idea that manufacturers did find a great deal of money for this object, which, he admitted—in fact, he happened to be well acquainted with a man who had given £40,000 for the purpose,—but what he said was that it was not general, and until it was we should never succeed.

Professor UNWIN being called upon, said the discussion had drifted so far into regions with which he was not very well acquainted that he had not much to say, though he had been much interested with the special question which had occupied part of their attention, namely, the workshop schools which had been described by Mr. Dixon. He began training under the old system, and spent some ten or twelve years in practical work, after which he had to take to teaching, and he carried with him to the school rather the old idea that a school should not and could not be

a workshop. That made him more interested to hear what was being done in the way of combining workshop instruction with the schools. But, he confessed, what struck him with regard to the paper was that although they were making a heroic effort to combine the workshops and the school, they were after all only giving the lads one afternoon's instruction a week in practical work which no doubt was very useful, but it was quite obvious that that did not at all take the place of the workshop; and he, therefore, came back to the old view that a handicraft must be taught rather in the workshop than in the school.

Mr. WEALE (Bruges) said he had lived so long out of England that he was not very well acquainted with what was going on here at present, but no doubt the great difficulty was that which had been referred to by Mr. Mundella: the unwillingness of parents to keep their children at the primary schools. He had often tried to find out how it was, and, as a general rule, he believed it was because they thought their children were not deriving in those schools any help towards earning their living; and, that the reason why they took them away so soon was because they did not see that if the children stayed at school a year or two longer they would be able to make a better position for themselves than if they left when they had attained the fourth or fifth standard. He was convinced also that in many districts the education given in the Board School was really too literary, and that there would not be the same objections to keeping them longer if a certain amount of technical education were given in all primary schools. If a boy had been all the morning at arithmetic or literary work, and then went to technical work, it was a sort of recreation, it brought into play different powers of the mind; and instead of feeling that fatigue which children did when they left school after several hours of mental work they would go away much fresher. He had lived in Belgium a long time, and was much interested in the technical schools there, and he had not found amongst the parents that disinclination to leave the children at

school; on the contrary, he found they encouraged one another to keep them longer, and were willing to make sacrifices for them, because they felt that their children were getting such knowledge as would enable them, when they left, to make their way better in the world. He thought that the drawing a hard and fast line—that no technical instruction should be given unless a child had attained the fifth standard—was a mistake, although of course it depended very much on the class of the children. For instance, in an agricultural population technical instruction should be allowed to be given to children in a lower standard than in towns, where the children were sharper, and learnt literary subjects more quickly.

MANUAL TRAINING SCHOOLS.

By C. M. Woodward.

I have been asked to speak on Manual Training Schools. The name is American, and I believe it has a characteristic meaning. Yet there has been little chance for originality. For fifty years the air has been full of ideas which have finally taken shape in a new phase of education. I have rarely shown our school to a person of mature years who did not confess to me that he had long cherished the idea of just such a school.

I shall not speak of what has been done for manual education in other lands. I shall confine myself to the growth of the St. Louis School, its character, and its influence in the United States.

In the summer of 1872, a complete set of hand and machine tools for light work in wood and metals was, at my suggestion, bought for the use of the engineering

students in Washington University. The students were from sixteen to twenty-four years of age, and were of collegiate rank, *i.e.*, they were engaged upon a four years' course of study, admission to which had been secured by a preparatory course in algebra, geometry, elementary physics, history, geography, some knowledge of Latin, and either French or German. At first the tools were used to construct models for illustrating the principles of mechanics and stereotomy, but it soon became evident that what was needed most was a series of lessons upon the nature and use of the tools themselves. Accordingly, with the help of a house-carpenter, such lessons were undertaken. Gradually the instruction was systematized, more tools were bought, new shops were fitted up, and expert teachers were employed, and regular class-exercises in joinery, wood-turning, iron-turning, chipping and filing, and in forge-work, were incorporated into the programmes of the several classes. This was achieved by the summer of 1877, when the report of the admirable beginning made by President J. D. Runkle of the Massachusetts Institute of Technology in Boston, and the full exhibit of the Russian Technical Schools on the theory and use of tools, at Philadelphia in 1876, greatly assisted in giving to our methods permanent shape.

In 1877 I published a small pamphlet on Manual Education, and in 1878 I gave an address on the same subject before the St. Louis Social Science Association. This address was published both in St. Louis and New York. Encouraged by our experience with advanced students during five years, it was decided in 1879 to establish a separate department of Washington University for boys below collegiate grade, in whose course of instruction, mechanical drawing and tool practice should hold equal place with the ordinary study of books.

For this school I proposed the name "Manual Training School," and suggested that its meaning could be learned only from an examination of the school itself. The name was approved, and the ordinance establishing the school

was adopted on 6th June, 1879. From that day the term "Manual Training School" is held throughout the United States to signify a school resembling the St. Louis school, both in the ends aimed at, and the means employed.

The course of instruction remains substantially as I arranged it five years ago. It covers three years of about forty weeks each. Boys entering the junior class must be at least fourteen years old, and reasonably proficient in arithmetical operations involving vulgar and decimal fractions, and denominate numbers. They must be fairly read in geography, and familiar with the essentials of plain English composition.

The daily programme of every boy throughout the course, in addition to drawing and shop work, which together occupy three hours, embraces three recitations upon assigned lessons which are studied at home, one in mathematics, one in natural science, and one in language and literature. The better to exhibit the method of the school I append a schedule of the daily exercises for the coming term. (See Table on next page.)

The daily session begins at 9 A.M. and closes at 3.20 P.M. We have no session on Saturday, though the boys are fond of coming on that day to bring up their work or to do extra.

The school will enter upon its fifth year next month. It has graduated two classes of twenty-nine young men each. The enrolment last year was 201 pupils, and ten full-time assistant teachers. An accomplished lady teacher has been added to the corps for next year.

Now, some will ask, What is the object of this course of training? What do you expect your pupils to become? What careers will they follow? They comment in this fashion:—The course is not sufficiently literary to serve as a preparation for a literary career; and it is too diffuse for the schooling of a mechanic. They point to scores of eminent men, lawyers, clergymen and authors, on the one hand; and to successful mechanics who have become manufacturers and commercial and railroad magnates, on

MANUAL TRAINING SCHOOL.

Daily Programme, First Term, 1884-5.

Class.	*Section.*	9:00 till 11:00.		11:00 till 1:00.		1:00 to 1:20	1:20 till 3:20.	
First.	A	Machine Shop.		Mechanics.	Geometry.	Recess.	French.	Drawing.
	B.	Drawing.	Geometry.	Machine Shop.			Latin.	Mechanics
	C.	Mechanics.	Geometry.	Drawing.	History and Literature.		Machine Shop.	
Middle.	A.	Forging Shop.		Physics.	Algebra.	Recess.	Drawing.	History and Literature.
	B.	Algebra.	Physics.	Forging Shop.			History and Literature.	Drawing.
	C.	Drawing.	Algebra.	Latin.	Physics.		Forging Shop.	
Junior.	A.	Woodworking Shop.		Arithmetic.	Science.	Recess.	Drawing.	Latin.
	B.	Lessons in English.	Drawing.	Woodworking Shop.			Arithmetic.	Science.
	C.	Drawing.	Arithmetic.	Woodworking Shop.			Science.	Lessons in English.
	D.	Latin.	Drawing.	Arithmetic.	Science.		Woodworking Shop.	

In the Junior Class Penmanship takes the place of Drawing once a week.
There is continual practice in English Composition in connection with Language and Literature.

C. M. Woodward,
Director.

St. Louis, July 8, 1884.

the other, and claim, truly enough, that in their school days the former did not meddle with practical mechanics, nor the latter with much science and literature.

While thus attacked on both flanks, I hold my position secure. We know well enough what we have been able to do with the old methods of education. We have yet to learn the full value of the new. By their fruits we shall know them. We have planted a new tree; its roots run out into the fertile earth in all directions; it does not draw its support and nourishment all from one side; it stretches out its branches towards every quarter of the heavens; it is tall and beautiful and strong, and it will bear splendid fruit.

I am well aware of the fact that in America public education is a very different thing from what it is on the continent of Europe, and perhaps in England as well. We have no impassable social barriers. It would be unpopular in America, where all men are born equal, for any school to set out to train children to occupy positions in life which are held to be low in the social scale. If we aim directly at any, we must aim at the highest. Wealth always commands social position, but so do certain kinds of culture without wealth. People who are familiar with literature, art or science (devotion to which is impossible on the part of those who day by day must earn their daily bread) wear the insignia of wealth, even if they have not wealth itself, and hence they take high social rank.

Now nearly all the machinery of education may be said to be in the hands of persons of this sort, persons who have had very little to do with the acquisition of wealth, but who are fully alive to the opportunities and privileges which wealth brings. It is not strange, then, that all systems of education aim rather to teach how to use wealth than how to get it; how to live, than how to make a living. The tendency of education has thus been away from the daily pursuits of working people. We have studied books rather than tools; the occupations of the counting-room and bank, rather than those of the draughting-room and the factory.

The history and literature and life of the past have been cultivated more than the activities and language and conditions of life to-day. I say it is not strange that it has been so; it is only strange that the teachers have had their way so long; that public education has not long ago been made to touch the lives of our people at more points. It needs no political economist to tell us that the great majority of our people must work for their living, and that their moral and intellectual condition depends more upon their ability to make a good living than upon their knowledge of the principles of ethics, or of what passes for ancient history. A criminal is more likely to be without the knowledge of a useful trade than to be illiterate.

Now the Manual Training School is an attempt to stem the tide of popular education, and to direct it in part into new channels. It has been running on a bed too narrow, with banks too high. We would do as does the thrifty farmer on the thirsty plains of Colorado with the cool streams that flow from the Rocky Mountains; we would turn its refreshing waters into every field, and give new life and a healthy growth to every plant. To change my metaphor, we do not strive to build the Manual Training School upon the ruins of any portion of the great temple of education. We tear nothing down, we wish to build up; we wish only to add the omitted wings which are absolutely essential to the symmetry of the perfect structure.

To return, now, to the question, "What do we aim to make of these boys?" I answer, we aim to make *men* of them. Whether they will become mechanics, or architects, or lawyers, or doctors, or scientists, or journalists, or artists, or teachers, I cannot tell. I doubt not they will be found in due time in all honourable professions and occupations. We strive to open every door; to pull down every obstacle which would turn them from any respectable calling; to shield them from the baneful effects of a silly prejudice and a false gentility; to teach that in every occupation there is a demand for brains and room for study and culture and intellectual life. We know that in the past it has been the fashion to assume that men who have cultivated their

brains, have little occasion to know how to use their hands; and that to be a mechanic and to make one's living by manual labour is *primâ facie* evidence of a lack of culture or a lack of brains. We swing to neither extreme, we would combine mental with manual training; we would at one and the same time lay the foundation for good scholarship and for good artizanship. Our motto is: "The Cultured Mind, the Skilful Hand."

We claim that it is the birthright of every child to be taught the three methods of expression: 1st, by the written, printed, or spoken word; 2nd, by the pencil and brush, using the various kinds of graphic art; 3rd, through the instrumentality of tools and materials which enable one to express thought in the concrete. Each of these methods has its advantages and its limitations. To have command of but one, or but two, is to be imperfectly educated. The master will use one method or another as external circumstances may suggest, not as insufficient training might require.

I thus incorporate manual training as an essential feature in the general education of every boy. It is not for a class, a guild, a profession, or a section; it is for all. As English boys attend Eton or Rugby with no very definite plans for life, so in St. Louis, Chicago, and Baltimore, boys attend a manual training school for an education. Their faculties are to be developed, and their growth in the school is to make clear the way in which they can best serve their own interests and their fellow men. They come from all sorts of homes, the sons of employer and of employed, of native and of foreign born.* Side by side

* I had almost said "bond and free," but as yet the education of the blacks is almost wholly of the old sort. I have strongly recommended manual training for the coloured schools; thus far they have generally lacked either the disposition or the means to follow my advice. There are several colleges where negro boys are taught Latin, Greek and mathematics, that they may become preachers, or teachers of Latin, Greek and mathematics to other negro boys. In but two or three are they taught to be mechanics. The schools at Hampton, Va., and at Tuskagee, Ga., are fine examples of the new type.

they study geometry and physics; they learn to draw, to swing the hammer, and to push the file. The only aristocracy is that of intelligence. On the whole, the lad who has a name to win is more likely to succeed than he who inherits one.

The daily programme given above shows not only the order in which the exercises of each section follow each other, but almost the entire course of study. During the second term, chemistry follows mechanics in the first class; rhetoric follows history in the middle class; algebra follows arithmetic in the junior class. The size of a section varies with the class. In the junior, twenty-four boys are taught together, in shop, in drawing, and in recitation; each of the two wood-working shops must, therefore, contain twenty-four benches, and twenty-four lathes. A section of the middle class consists of twenty-two boys; one of the first class, twenty. The number of boys we can accommodate in school on our present plan is 222; this figure we shall probably reach next year.

In shop every boy has a separate set of edge tools, for which a lock-drawer is provided; for the care and condition of these tools he is responsible. Other tools belong to the bench, anvil, or lathe, and are common to the three boys who are assigned to the same place during the different shop hours. The school owns all the shop tools, and furnishes all shop materials. In drawing the boys furnish their own instruments and paper.

The instruction in practical mechanics is given in the shops themselves. The tools are given out one at a time, and their peculiarities of construction, care, and use are fully explained and illustrated. The exercises of a class are carefully devised to contain the "points" logically arranged. The instructor at the bench, anvil or machine, executes the day's lesson in the presence of the class, freely using drawings, explaining processes, and giving reasons for every step. He tests his work before his pupils, and teaches them to be critical and exact, by being critical and exact himself. The boys take notes, make sketches, ask

and answer questions, till all seems easy and clear; they are then sent to their places and set to do the work themselves. Each is furnished with the same tools and raw material. The instructor watches their progress and gives help where help is needed. A heedless boy is heedless in the shop; he misunderstands the teacher; he cuts off the wrong end of his piece; mistakes the right for the left; gets a mortise upside down; or inverts the order of execution. The consequences of such heedlessness are unmistakable when embodied in wood or iron, especially when a second supply of material has to be paid for out of one's spending money. The blunderer sees his blunder in a strong light, and learns a most important lesson. The shop work is most absorbing; the boys are thoroughly alive and generally give the closest attention. It is easy to see that throughout the two hours, the exercise is both moral and intellectual. At a specified time (and the execution of an exercise may cover a single hour, or the shop-time of several days) the work is called in, examined, criticized and graded.

All the shop-work is disciplinary. The tools used are the parent ones, and the processes are as typical as possible. Special trades are not taught, nor are articles made for sale. The scope of a single trade is too narrow for educational purposes. Manual education should be as broad and liberal as intellectual. A shop which manufactures for the market, and expects a revenue from the sale of its wares, is necessarily confined to saleable work, and a systematic and progressive series of lessons is practically impossible. If the object of the shop is education, a student should be allowed to discontinue any task or process the moment he has learned to do it well. In a factory a boy is kept on what he can do best, at the expense of breadth and versatility. In a factory, intellectual life and activity are not aimed at; everything is for the benefit of the business. In a manual training school, everything is for the benefit of the boy; he is the most important thing in the shop; he is the only article to be put upon the market. From this it

appears that the school is wholly co-operative; every boy is an owner in the out-put, and all the profits are divided among the stockholders.

We can teach the theory and use of tools without producing a single article of intrinsic value, just as one can become a good marksman without shooting a single bird, beast, or Indian. To be sure, one cannot become a hunter or a soldier without something besides rifles and targets; and so we cannot teach the trade of a house- or engine-builder without something beyond abstract exercises. These professional touches, however, do not belong in a school for general education.

Near the end of his course, we require of every boy the execution of a project, which consists of the making of a complete machine, including often the drawings and the patterns. This work has generally been very well done, and shows the value of exercise drill. The projects for June 1884 consisted of: two horizontal slide-valve engines, with cylinders four by six inches, each built by five boys in combination; a 15-inch speed lathe; a boring bar; an emery grinder; a set of planer centres; several jack-screws; a hydraulic jack; a combination table rest; a brass electrical machine, and other minor pieces.

Now as to the relation which our instruction bears to the crafts in most frequent use. During the total allowance of 380 hours, which in the first year every boy of the class must devote to woodwork, the boys are learning some of the preliminary steps and essential features of several wood-working trades. The sharpening of chisels, gouges, bits, and planes; the filing and setting of saws; learning to square up and lay out work with precision; the cutting of mortises and tenons; the details of nailing, glueing, pinning, and dovetailing; various kinds of inside and outside turning, chucking and fitting, &c., &c. All these belong equally to the cabinet-maker, the chair-maker, the pattern-maker, the wheelwright, the house-carpenter, the stair-builder, the cooper, the car-builder, the wood-carver, and so on.

While thus learning the intelligent use and care of tools

and materials, our boys become quite proficient in making and using what are called "working drawings." This last accomplishment is essential to intelligent progress in any trade.

The training given during the second year of school in the forging shop is equally fundamental and equally broad in its application. The study of form as related to strength and economy of material; the operations of drawing, upsetting, bending, punching, breaking, welding, tempering, brazing and soldering, are fundamental in character and preparatory to a score of distinct occupations, the special business and conventional details of which we do not pretend to teach.

Our machine shop, in which the third-year students spend their 380 hours of shop time, is quite appropriately named. To be sure, there are benches where regular exercises in chipping and filing are done, but the greater part of the attention is given to the study, use, and management of machines. To this end, machines with great range of adjustment, and always requiring precision and the exercise of forethought and good judgment, are employed. The materials wrought are those of which machines are generally made, viz., iron, cast and wrought, steel of various grades, and brass. Their cutting tools the students generally make for themselves at the forge. We have in all twenty-one iron cutting machines, and a sixty-horse power Corliss engine. It is no small thing to be able to use all these machines intelligently, not to say skilfully, and in this age when many new machines are to be made, and all sorts of machines are to be used in the arts, there can be no surer way than ours of developing that "directive power" which is generally conceded to be one of the chief fruits of a good education.

It must be borne in mind that every boy who takes the entire course of the school receives in regular order all the training I have described, as well as the regular book training in literature and science day by day. He has no option to take more of one and skip another.

Now, whether our boys become mining, or civil, or mechanical engineers, farmers or mechanics, merchants or

manufacturers, it seems clear that this training will give them additional power both in moulding circumstances and in their intercourse with men, taught and untaught, skilled and unskilled.

A word in regard to the daily allowance of time for shop-work. I have noticed in all European industrial schools that from four to eight hours are given to shop work daily, while comparatively little time is devoted to the study and exposition of books. With us it is just the other way. The regular time in shop is two hours per day, and in spite of an occasional sneer from one who would admit the value of nothing less than ten hours a day, I think two hours enough. It is educationally useless to prolong any exercise beyond the time when it ceases to occupy the thoughts of the pupils. With boys as young as ours, it is practically impossible to secure close attention longer than about two hours at a time. With still younger pupils the exercises should be shorter. Our conclusion is confirmed by Mr. Foley of Boston, a shop-teacher of several years' experience. He finds that, working with students two or three years older than ours, three-hour exercises are the best, and he decidedly objects to four hours, as the interest flags and less progress is made.

One hour per day is uniformly given to drawing, free-hand or mechanical, using the pencil, pen, or brush. In the future penmanship will be taught as a part of drawing.

A few queries will naturally arise in your minds which I will try to anticipate. Our students are from all classes in the community, the majority being from families in moderate circumstances. We have explicitly said in every prospectus we have issued, that "the school is not an asylum for dull or lazy boys." Our conditions of admission have been rigid, and we have rejected about one-third of all applicants for insufficient preparation in ordinary school work. Morally and intellectually our pupils are a little above the average, and they may be assumed to be somewhat predisposed to practical mechanics.

The progress in ordinary school work has been fully as

good as in other schools for boys of equal age. This opinion is confirmed by teachers and visitors. Dr. Belfield, the director of the recently-opened manual training school in Chicago, who has been a close observer of our school, says :—

"Of this I am confident, that three years of a manual training-school will give at least as much purely intellectual growth as three years of the ordinary high-school, because every school hour, whether spent in the class-room, the drawing-room, or the shop is an hour devoted to intellectual training. I am also convinced that the manual training school-boy's comprehension of some essential branches of knowledge will be far superior to that of the high-school-boy."

I may specify that in Latin, French, and English they have done average work ; in mathematics and physics they have made unusual progress ; in draughting, plain and finished, they have surpassed all expectation. It has been abundantly proved that every boy of average ability can become a good draughtsman, and that too while still young.

That our pupils acquire a taste for hard study and a fondness for books, has been shown by the desire on the part of at least one-half of our graduates to enter the Polytechnic School (for which the Manual Training School affords full preparation), and take its entire course of four or five years of advanced work, with a view to becoming accomplished engineers or scientists. Those already engaged in this work have taken high rank.

There is an eagerness and a promptness among our pupils which makes the school easy to manage. At home, on the street, and during leisure hours, the boys think and talk of school work. Every household bears evidence of newly-acquired manual skill. Half the boys organise shops at home, and apply their school exercises to practical work, to the great delight and convenience of mothers. As a rule, the brightest scholars become the best workmen, while success in one direction has generally the effect of encouraging effort in another. Differences which show plainly

when boys first come to us disappear with opportunities for fuller development.

If you ask, as many have asked me at home, if any of the boys look upon their manual exercises as humiliating; if they shrink from soiling and hardening their hands; if they object to being seen in overalls and blouses with greasy fingers and sweat-streaked faces, I answer, No. They are as proud of their skill in the shop as in the recitation room. It is a great source of pleasure to the boys to visit manufacturing establishments, and to see operations of which they know something on a small scale, skilfully applied on a grand scale. They do not seem to notice the workman's dress or dirty face, but if he exhibit skill that they can appreciate, they admire him, and treat him with profound respect. This absence of prejudice, this quick appreciation of intelligence, is most satisfactory and encouraging. Our graduates that go to work turn naturally and from choice to mechanical pursuits. Clerkships have little to attract them; they long for the interesting activities of tool-work. The testimony of employers thus far has been, that the boys are apt to learn, attentive, trustworthy, and much more skilful than was expected. One boy has generally served as a good recommendation for another. In ordinary shops they are more than a match for boys of equal age who have had two entire years of apprenticeship.

The time allowed me does not admit of a full discussion of the advantages of manual training. I beg to refer you to an article in the *Popular Science Monthly* for July, 1884, on "The Fruits of Manual Training."

As to cost, you need not be told that a manual training school, with its suite of shops, drawing and recitation rooms, with its equipment of desks and tables, benches, tools, and machinery, is much more costly than a school with only recitation rooms and desks. Our current expenses, too, are about double those of ordinary schools per pupil. Our average annual cost of materials is about $10 per boy. Our school day (six full hours) is at least an hour longer than

the average, and our working sections are much smaller. I need an assistant for every twenty boys in the school.

Competent teachers for the shops cost about $1200 each. They have not been easy to find, for the old system of education did not train them; neither the old mechanic nor the old schoolmaster would do. In the future we shall find plenty of teaching material of the best sort among our own graduates.

It will now be asked, how can poor boys attend such an expensive school? I answer, that thus far about one-fourth of the pupils have been on the free or reduced list. This has been made possible in the past by subscriptions of money from friends. During the present year an endowment of $120,000 has been secured by will and by gift. The income of this fund will be mainly spent in paying for the tuition of boys of limited means. As such boys win scholarships (as places on the free or reduced list are called) only by excellent records, it is held an honour to get one; and to hold one the good record must be maintained.

Our full tuition fees (there are no extras) are by the year: Junior class, $60; Middle class, $80; First class, $100.

Our school is very popular. More applicants are coming this summer than we have room for. They come from other cities, from country towns, and from distant States. The wage workers speak well of us, and send their sons whenever they can, but it is obvious that a school for 220 boys can do little for a constituency of a million people.

A few men refuse to believe in us. They are generally men who went into shops at an early age, some of whom developing great energy, skill, shrewdness, and force of character, have risen to positions of wealth and influence. Such men are prone to think that the roads they travelled are the only roads; that if a boy is not going to be a mechanic he should let tools alone; that a mechanic must grow up among workmen in a real shop; that long days, and drudgery and dirt, yea, and seasons of intense weariness and discouragement even, are essential to the making of a good mechanic.

Such men are generally so sure of the worthlessness of our school that they do not care to come and see what we are doing.

The evident success of the St. Louis Manual Training School has led to a wide discussion of its methods and aims, and to the establishment of similar schools in other cities. The first to move was our sister city Chicago. Its Commercial Club has spent $100,000 in a most admirable plant for a manual training school. It was opened last spring. Thus far it has been very successful. The school is closely modelled after ours. Its rates of tuition are the same, and I believe it is proposed to establish a number of free scholarships. The school building stands on the most beautiful avenue of the city.

A year ago Superintendent Seaver, of the Public Schools of Boston, urged the opening of a manual training school for 300 boys as a part of the public school system of that city. His advice has been only partly followed. In April last he opened a woodworking shop, which serves as an annex to several of the public grammar schools. It is expected that next year additional shops will be opened in connection with their English high school.

In Baltimore a free manual training school was opened in March last. It appears to be in a very flourishing condition, though somewhat crippled for funds.

Toledo, Philadelphia, Cleveland, San Francisco, and other cities will soon follow suit, putting manual training into the public schools. The main difficulty is the lack of available money.

In conclusion, let me predict that some form of manual training is destined to be fully incorporated into American public education. Too long have we tolerated a one-sided system; too long have books and literary culture monopolized the machinery of the schools and shut out other kinds of culture as useful, as noble, as intellectual, as humane as that of letters. We are learning that one must be useful before he can be ornamental; that the mechanical arts must precede the fine arts; that in this age, which I have

ventured to call the DYNAMIC AGE, there are other forces to be studied and utilized besides those of authority and tradition; that there are many ways of studying human progress; a great variety of opportunities for making much of ourselves and the world better for our having lived in it.

I thank you for the honour of an invitation to contribute a paper to this Conference. It is natural that we should be deeply interested in each other's work; but there was little need of a word from me. Your able representative of the Royal Commission, Mr. William Mather, looked so closely into our educational affairs last year, and he has interpreted us so faithfully and generously, that there was little left for me to say. In education, as in nearly everything else, we have learned much from you. I am happy to acknowledge the debt which on educational matters I personally owe to John Scott Russell, to Sir Joseph Whitworth, to Herbert Spencer, to Professors Magnus, Thompson, and Huxley, and to many others whose names I have not time to give.

TEACHING OF NATURAL SCIENCE.

TUESDAY, AUGUST 5, 10 A.M.

Chairman: Mr. PHILIP MAGNUS.

THE CHAIRMAN, in introducing Dr. H. E. Armstrong as the reader of the first paper for the day, said that Dr. Armstrong was doubtless known to many of those present as the professor of chemistry at Finsbury Technical College. He would hold his post there for a short time, and then he would become professor of chemistry in the building in which the meeting was then assembled, and the laboratories of the institution would be placed under his charge.

ON THE TEACHING OF NATURAL SCIENCE AS A PART OF THE ORDINARY SCHOOL COURSE AND ON THE METHOD OF TEACHING CHEMISTRY IN THE INTRODUCTORY COURSE IN SCIENCE CLASSES, SCHOOLS AND COLLEGES.

By HENRY E. ARMSTRONG, Ph.D., F.R.S., Sec.C.S.,

Professor of Chemistry in the Finsbury Technical College.

HOWEVER fully it may be admitted by the few that it is important, nay essential, that all members of the community, whatever their station or occupation, should during

their school career receive some instruction in the elements of Natural Science, the general public have not as yet had brought home to them with sufficient clearness that just as a knowledge of foreign language is essential to all who are brought into intercourse with foreigners, so in like manner is a correct knowledge of the elements of natural science of direct practical value to all in their daily intercourse with Nature, apart from the pleasure which such knowledge affords. In fact, judged from a purely utilitarian standpoint, the advantages to be derived from even the most elementary acquaintance with what may be termed the science of daily life are so manifold that if once understood by the public, the claims of science to a place in the ordinary school course must meet with universal recognition. To quote Huxley*: "Knowledge of Nature is the guide of practical conduct . . . any one who tries to live upon the face of this earth without attention to the laws of Nature will live there for but a very short time, most of which will be passed in exceeding discomfort: a peculiarity of natural laws, as distinguished from those of human enactment, being that they take effect without summons or prosecution. In fact, nobody could live for half a day unless he attended to some of the laws of nature; and thousands of us are dying daily, or living miserably, because men have not yet been sufficiently zealous to learn the code of Nature."

But it is also and mainly on other and far higher grounds that we should advocate universal practical teaching of the elements of natural, and more particularly of so-called physical, science: viz., that it tends to develop a side of the human intellect which, I believe, I am justified in saying is left uncultivated even after the most careful mathematical and literary training: the faculty of observing and of reasoning from observation and experiment. It is

* This writer's "Introductory" to Macmillan's Science Primers, and his "Physiography: an Introduction to the Study of Nature," should be studied by all who wish to know what science is and how it should be taught.

entirely from this latter point of view that I shall venture to propound a scheme for teaching the elements of that branch of physical science with which I am most intimately acquainted.

This Exhibition affords some few noteworthy illustrations of the way in which the importance of teaching the elements of natural science has received practical recognition in our schools. Thus we have indications of the work being done by the Birmingham School Board; the London School Board call attention to their system of training pupil-teachers in science; Mr. Robins shows plans of one of the best, if not the best, equipped school chemical laboratory—that of the Manchester Grammar School. Also, it is well known that at many of the larger schools, such as Clifton College, Eton, Harrow, Rugby, St. Paul's, Giggleswick and the North London Collegiate School for Girls, ample provision is made for teaching one or more branches of natural science; and not a few other examples might be quoted. But in how large a proportion of the schools throughout the country is such training neglected? and there is much cause for complaint in the fact that in those schools in which science is taught, it is after all in most cases but a kind of "refuge for the destitute," only those who have failed on the classical side and those judged to be inferior in intellect being turned over to the so-called modern side. This is probably due to a variety of causes: to the ignorance already referred to of the public of the importance and value of such training, or it would be demanded of the schools; to the ignorance of even the barest elements of science of the majority of teachers in charge of schools; to the want of good science teachers and of suitable books; to the supposed expense of teaching science; and lastly—and I believe this to be the most important of all the causes which operate against the teaching of science—to the imperfection of our method of teaching: there can be little doubt, in fact, that the majority of teachers of the generally recognised subjects who have themselves no scientific knowledge see clearly enough

that very little good comes of teaching science in the manner in which it is commonly taught in schools.

The great objection to the method at present in vogue appears to me to be that it is practically the same whether science is taught as a part of the general school course, or whether it is taught professionally: in other words, a lad studies chemistry, for example, at school in just the same way as at a science college, the only difference being that he does not carry his studies so far at school as at college. This, I believe, is the primary fault in our present system. In my opinion, no single branch of natural science should be selected to be taught as part of the ordinary school course, but the instruction should comprise the elements of what I have already spoken of as the science of daily life, and should include astronomy, botany, chemistry, geology, mechanics, physics, physiology and zoology — the olla podrida comprehended by Huxley under physiography, but which is perhaps more happily expressed in the German word *Naturkunde*—in so far as is essential to the understanding of the ordinary operations and objects of Nature, the teaching from beginning to end being of as practical a character as possible, and of such a kind as to cultivate the intelligence and develop the faculties of observing, comparing and reasoning from observation; and the more technical the course the better. The order in which these subjects should be introduced is matter for discussion; personally, I should prefer to begin with botany, and to introduce as soon as possible the various branches of science in no particular order but that best suited to the understanding of the various objects or phenomena to which the teaching for the time being had reference. The extent to which instruction of this kind is given must entirely depend on the class of scholars.

There are few teachers capable of giving such instruction, and fewer books of a character suited to ordinary requirements. The development of such a system will, in fact, require the earnest co-operation of a number of specialists; but apart from the difficulty of securing efficient co-opera-

tion, there is no reason why some such scheme should not be elaborated at no distant date. If action is to be taken, however, there must be no delay, or the opportunity will be lost. I trust that this meeting will be prepared to give much attention to this question, and that it may be possible to continue the discussion on other platforms, as it is fundamentally important and deserving of the most serious consideration of educationalists. No doubt it will be said that the object of introducing the teaching of science into the school course is to afford mental training of a particular character, not the inculcation of useful knowledge, and that this end can be secured by teaching well some one branch of science. Admitting that this has been the case, however, there is no reason why it should be in the future: if while developing the intellect it be possible—and it certainly is—to impart much valuable information; and if —as it certainly is—the teaching be rendered easier and more attractive because it has direct reference to the familiar objects and operations of Nature. We cannot, indeed, any longer afford to grow up ignorant of all that is going on around us, and without learning to use our eyes and our reasoning powers; we cannot afford to be unacquainted with the fundamental laws of health; but we must ever remember "that knowledge of Nature is the guide of practical conduct," and no effort must be spared to render our system of education an effectual preparation and truly adapted to the exigencies of practical life. The female educators appear already to have grasped the importance of such teaching, and under the guise of domestic economy much that I advocate is being taught in girls' schools; it is to be hoped that ere long something akin to the domestic economy course in girls' schools will find a place in boys' schools.

To pass now to the consideration of the mode of teaching my own special subject in science classes, such as those held under the auspices of the Science and Art Department, and in the introductory course for students in science schools and colleges generally. To deal first with the

former. Inspection of the syllabus for the elementary stage, together with the study of the examination papers of the past few years, will show that the student is mainly required to have an elementary knowledge of the methods of preparing, and of the properties of the commoner *non-metallic* elements and their chief compounds. There is thus practically no distinction to be drawn between the knowledge required of students under the Science and Art Department, and of those who are making the study of chemistry the business of their lives. But surely it is not the function of the Science and Art Department to train up chemists, and I am satisfied that it is neither their desire nor their intention to do so; their object undoubtedly is to encourage the teaching of chemistry as a means of cultivating certain faculties, and in order that the fundamental laws of chemistry may be understood and their commoner applications realised. It is not difficult to understand how the system has grown up and why it is maintained; I do not believe it is because the Department consider it a satisfactory one; but they know full well that a better system is not yet developed, and that it would be unwise to legislate far in advance of the intelligence and powers of the majority of the teachers. With all deference, however, I venture to add that the programme has been drawn up too much from the point of view of the specialist, and that too little attention has been devoted to it from the point of view of the educationalist. The course I am inclined to advocate would be of a more directly useful character. There is no reason why in the beginning attention should be confined to the non-metals, especially when certain of the metals enter so largely into daily use; and provided that it involve no sacrifice of the opportunities of developing the faculties which it is our special object to cultivate by the study of chemistry, there is no reason against, but every reason for, selecting subjects of every-day importance rather than such as are altogether outside our ordinary experience, such, for example, as the oxides of nitrogen: even chlorine, except in relation to

common salt, might be omitted from special study. The presumed distinction between so-called inorganic and organic chemistry should be altogether put aside and forgotten, and the elements of the chemistry of the carbon compounds introduced at a very early stage in order that the phenomena of animal and plant life might come under consideration. To give the barest possible outline of a programme, I would include such subjects as the following in the syllabus:—

The chemistry of air, of water and of combustion. The distinction between elements and compounds. The fundamental laws which regulate the formation of compounds and the chemical action of bodies upon one another (*i.e.* the nature of so-called chemical change). The chemical properties of the metals in ordinary use with special reference to their uses and the action upon them of air, water, &c. The composition of natural waters. The distinction between fats, carbohydrates and albuminous substances in so far as is essential to the understanding of the relative values of different foods and respiration and growth in animals and plants (outlines of the chemistry of animal and plant life, in fact); the nature of the processes of fermentation, putrefaction and decay.

The instruction in these subjects should in all cases be imparted by means of object-lessons and tutorial classes; lectures pure and simple should, as far as possible, be avoided. The students should by themselves go through a number of practical exercises on the various subjects. I would abolish the teaching of tables for the detection of simple salts, the teaching of analysis, as at present conducted, being, I believe, in most cases, of very little, if any, use except as enabling teachers to earn grants.

In schools and colleges in which chemistry is taught as a science, and ostensibly with the object of training young people to be chemists, it is the almost invariable practice that the student first devotes more or less time to the preparation of the commoner gases, and then proceeds to study qualitative analysis; quantitative determinations are

made only during the later period of the course. I believe that the system has two great faults: it is too mechanical, and does not sufficiently develop the faculty of reasoning from observation; and actual practice in measurement is introduced far too late in the course. It is of great importance that the meaning of the terms equivalent, atomic weight, molecular weight, should be thoroughly grasped at an early stage, but according to my experience this is very rarely the case; there is no such difficulty, however, if the beginner is taught to make a few determinations himself of equivalents, &c., as he very well may be. It is not necessary here to enter into a more detailed criticism, but I propose instead to give a brief description of a modification of the existing system which in my hands, in the course of about four years' experience, has furnished most encouraging results, and which I venture to think is worthy of an extended trial.

Instead of merely preparing a variety of gases, the student is required to solve a number of problems experimentally: to determine, for example, the composition of air and of water; and the idea of measurement is introduced from the very beginning, as the determination is made quantitatively as well as qualitatively. Each student receives a paper of instructions—two of which are printed as an appendix to this paper—which are advisedly made as bare as possible so as to lead him to find out for himself, or enquire, how to set to work; and he is particularly directed that, having made an experiment, he is to enter in his notebook an account of what he has done and of the result, and that he is then and there to ask himself what bearing the result has upon the particular problem under consideration, and having done so, he is to write down his conclusion. He is thus at once led to consider what each experiment teaches: in other words, to reason from observation. Apart from the mental exercise which this system affords, if the writing out of the notes be properly supervised, the literary exercise which it also affords is of no mean value.

In illustration, I may here very briefly describe the

manner of working out the second problem in the course. The problem being: To determine the composition of water, the student receives the instruction: 1. Pass steam over red-hot iron brads, collect the escaping gas, and apply a light to it. (N.B. The gas thus produced is called hydrogen). He is provided with a very simple apparatus, consisting of a small glass flask containing water, joined by a narrow bent glass tube to an iron tube (about 9 inches long and $\frac{1}{2}$ to $\frac{3}{4}$ inch wide) in which the brads are placed, a long glass tube suitably bent for the delivery of the gas being attached to the other end of the iron tube. Plaster of Paris is used instead of corks to make the connections with the iron tube. The iron tube is supported over a burner, and heated to redness; the water in the flask is then heated to boiling, and the steam thus generated is passed over the brads; the escaping gas is collected over water in the usual manner. Having made this experiment, and observed that on passing steam over red-hot iron the gas hydrogen is produced, the student proceeds to consider the bearing of this observation. The hydrogen must obviously be derived either from the water or from the iron, if not from both. Those who already know that iron is iron, so to speak, at once infer that the hydrogen is derived from the water: it is, however, pointed out that even if it be known that iron is a simple substance, this observation taken alone does not prove that hydrogen is contained in water.

2. The student next learns to prepare hydrogen by the ordinary method of dissolving zinc in diluted sulphuric acid, and makes a few simple experiments whereby he becomes acquainted with the chief properties of the gas.

3. Having done this, he is instructed "to burn dry hydrogen at a glass jet underneath a cold surface and to collect and examine the product." The product is easily recognised as water, and the immediate answer to the question, "What does this observation teach?" is, that since iron is absent, taken in conjunction with experiment 1, the production of water on burning hydrogen in

air, the composition of which has already been determined, is an absolute demonstration that hydrogen is contained in water.

4. Having previously studied the combustion of copper, iron and phosphorus in air, and having learnt that when these substances burn they enter into combination with the oxygen in air, the student is also led to infer from the observation that hydrogen burns in air producing water, that most probably it combines with the oxygen, and that water contains oxygen besides hydrogen. It may be, however, it is then pointed out, that the hydrogen, unlike the phosphorus, &c., combines with the nitrogen instead of with the hydrogen, or perhaps with both. He is, therefore, instructed to pass oxygen over heated copper, weighing the tube before and after the operation, and subsequently to heat the "oxide of copper" in a current of hydrogen. He then observes that water is formed, the oxygen being removed from the copper: and since nitrogen is absent, it follows that water consists of hydrogen and oxygen, and of these alone.

5. By repeating this last experiment so as to ascertain the loss in weight of the copper oxide tube and the weight of water produced, the data are obtained for calculating the proportions in which hydrogen and oxygen are associated in water.

In practice, the only serious difficulty met with has been to induce students to give themselves the trouble to consider what information is gained from a particular observation; to be properly inquisitive, in fact. I cannot think that this arises, as a rule, from mental incapacity. When we consider how the child is always putting questions, and that nothing is more beautifully characteristic of young children than the desire to know the why and wherefore of everything they see, I fear there can be little doubt that it is one of the main results—and it is indeed a lamentable result—of our present school system that the natural spirit of enquiry, inherent to a greater or less extent in

every member of the community, should be thus stunted in its growth, instead of being carefully developed and properly directed.

Having in the manner which I have described studied air, water, the gas given off on heating common salt with sulphuric acid, and the ordinary phenomena of combustion, the student next receives a paper with directions for the comparative study of lead and silver (see Appendix, p. 82). The experiments are chosen so as to afford an insight into the principles of the methods ordinarily employed in qualitative and quantitative analyses, and the student who has conscientiously performed all the exercises is in a position to specialise his studies in whatever direction may be desirable.

The system I have thus advocated undoubtedly involves far more trouble to the teacher than that ordinarily followed, but the student learns far more under it, and I assert with confidence that the training is of a far higher order, and also of a more directly useful character. I believe it to be generally applicable, and that it would be of special advantage in those cases in which only a short time can be devoted to the study of chemistry, as in evening classes and medical schools. At present the only practical teaching vouchsafed to the majority of students in our large medical schools is a short summer course, during which they are taught the use of certain analytical tables: as a mental exercise, the training they receive is of doubtful value; the knowledge gained is of little use in after life, and the course certainly ought not to be dignified by being spoken of as a course of Practical Chemistry: *test-tubing* is the proper appellation. It is not a little remarkable also that even the London University Syllabus nowhere specifies that a knowledge even of the elements of quantitative analysis will be required of candidates either at the Preliminary Scientific or First M.B. Examination, and this too when, as is well known, an analysis to be of any practical value must almost invariably be quantitative. It is little less than a disgrace to the medical

profession that a subject of such vital importance as chemistry should be so neglected.

If, however, we are to make any change in our method of teaching science; if we are to teach science usefully throughout the country, two things are necessary: teachers of science must take counsel together, and the examining boards must seriously consider their position. There can be little doubt that in too many cases the examinations are suited to professional instead of to educational requirements; and that the professional examinations are often of too general a character, and do not sufficiently take into account special requirements.

APPENDIX.

PROBLEM: TO DETERMINE THE COMPOSITION OF AIR.

N.B.—Immediately after performing each experiment indicated in this and subsequent papers, write down a careful description of the manner in which the experiment has been done, of your observations and the result or results obtained, and of the bearing of your observations and the result or results obtained on the problem which you are engaged in solving. Be especially on your guard against drawing conclusions which are not justified by the result of the experiment; but, on the other hand, endeavour to extract as much information as possible from the experiment.

1. Burn a piece of *dry* phosphorus in a confined volume of air, *i.e.* in a stout Florence flask closed by a caoutchouc stopper. Afterwards withdraw the stopper under water, again insert it when water ceases to enter and measure the amount of water sucked in. Afterwards determine the capacity of the flask by filling it with water and measuring this water.

N.B.—The first part of the experiment requires care and must be done under direction.

2. Allow a stick of phosphorus lashed to a piece of stout wire to remain for some hours in contact with a known volume of air confined over water in a graduated cylinder. After noting the volume of the residual gas, introduce a burning taper or wooden splinter into it.

N.B.—The residual gas is called *nitrogen.*

3. Burn a piece of dry phosphorus in a current of air in a tube loosely packed with asbestos. Weigh the tube, &c., before and after the experiment.

4. Repeat Experiment 2 with iron-borings moistened with ammonium chloride solution. Preserve the residual gas.

5. Suspend a magnet from one arm of a balance; having dipped it into finely divided iron, place weights in the opposite pan, and when the balance is in equilibrium, set fire to the iron.

6. Pass a current of dry air through a moderately heated tube containing copper. Weigh the tube before and after the experiment; also note the alteration in the appearance of the copper.

7. Strongly heat in a *dry* test tube the red substance obtained by heating mercury in contact with air. At intervals plunge a glowing splinter of wood into the tube. Afterwards note the appearance of the sides of the tube. (Before performing this experiment ask for directions.)

N.B.—The gas obtained in this experiment is named *oxygen.*

8. Heat a mixture of manganese dioxide and potassium chlorate in a dry test tube, and at intervals plunge a glowing splinter into the tube. This experiment is to acquaint you with an easy method of preparing oxygen in quantity.

9. Prepare oxygen as in Experiment 8 and add it to the nitrogen from Experiment 4 in sufficient quantity to make up the bulk to that of the air taken for the latter experiment. Test the mixture with a burning taper or splinter.

10. Dissolve copper in nitric acid and collect the escaping gas (nitric oxide); add some of it to oxygen and some of it to air.

11. Fill a large flask provided with a well-fitting caoutchouc stopper and delivery tube with ordinary tap water and gradually heat the water to the boiling point; collect the gas which is given off in a small cylinder and add nitric oxide to it. Also collect a sufficient quantity in a narrow graduated cylinder and treat it as in Experiment 2.

COMPARATIVE STUDY OF SILVER AND LEAD.

SILVER.—*Symbol*, AG. (*Argentum*). *Atomic weight*, 107·67. *Specific heat*, ·05701.

LEAD.—*Symbol*, PB. (*Plumbum*). *Atomic weight*, 206·47. *Specific heat*, ·03140.

1. Determine the relative density of lead and silver at a known temperature by weighing in air and in water.

2. Separately heat known weights of lead and silver for some time in the air, allow to cool, and weigh.

3. Separately convert known weights of lead and silver into nitrates, and weigh the latter. From the data thus obtained calculate the *equivalents* of lead and silver.

4. Convert the known weights of nitrates thus obtained into chlorides, and weigh the latter.

5. Compare the action on lead and silver of chlorhydric acid; of dilute and concentrated sulphuric acid, using the acid both cold and hot; and of cold and hot nitric acid.

6. Using solutions of the nitrates, compare their behaviour with chlorhydric and sulphuric acids, hydrogen sulphide, potassium iodide, and potassium chromate. Ascertain the behaviour of the precipitate formed by chlorhydric acid when boiled with water, and when treated with ammonia solution.

7. Compare the behaviour of lead and silver compounds on charcoal before the blow-pipe.

8. Tabulate the results of your experiments with lead and silver in parallel columns.

9. Ascertain whether the substances given you contain lead or silver.

10. Determine silver in an alloy of lead and silver by cupellation.

11. Study the method of determining silver volumetrically by means of a *standard solution* of ammonium thiocyanate. Determine the percentage of silver in English silver coinage.

12. Determine silver as chloride by precipitation.

13. Dissolve a known weight of lead in nitric acid, precipitate it as sulphate, collect and weigh the latter.

14. What are the chief ores of lead and silver? How are lead and silver extracted from their ores? How is silver separated from lead? How is it separated from burnt Spanish pyrites? What are the chief properties and uses of lead and of silver? State the composition of the chief alloys of lead and silver.

DISCUSSION.

Dr. GLADSTONE, in opening a discussion upon the subject of the paper, said that he had been asked to speak as an educationist rather than as a chemist. He had had the greatest pleasure in listening to the discourse which had been laid before them, and he was very glad to observe the boldness with which Professor Armstrong had enunciated many of the views which perhaps had been to a certain extent in the minds of some teachers, but which were not often expressed as publicly as they had been this morning. The main question before them, as he apprehended, was that which the reader had laid down as his first proposition. He had discussed the question, "To what extent is it desirable that any single branch of science should form part of the ordinary school course?" and the author had expressed his opinion that no single branch ought to form such part. He (Dr. Gladstone) concurred with that view. It appeared to him that to take chemistry, or physiology, or any one particular branch of science, and to make it one of the subjects of a school course, would not be treating the study of nature and of things properly. He claimed for the study of things the first position, and for the study of words only a second position. He was not one of those who, with Herbert Spencer, thought that they ought to study science only, for he held that mode of expressing and representing our ideas so as to convey them to the minds of other people was a matter of great importance; but he believed that the first thing was that they should have a knowledge of that which was round about them, and was constantly influencing them. It therefore appeared to him that a very large proportion of the time occupied in teaching, and especially, perhaps, in the teaching of the working classes, should be given to the study of nature in some way or other; and he did not think that the way to

accomplish this was to teach any special small department of nature, like that with which the science of chemistry dealt. Of course they ought to know something of the composition of the world around them; and the idea of elements and of chemical combination, and all such things was exceedingly important; but he thought that it ought to be part of a much greater course of instruction in natural science in general. This was wanted, not merely for the sake of information, but for the sake of mental training. No doubt chemistry and natural science were extremely useful for the sake of the information which they imparted; and those who were not fit for the higher studies might go on with the modern study of science, and this might be enlarged upon a little; but he claimed that science occupied a most important position on account of the mental training which it gave, as was stated in the commencement of the paper. Even after teachers had given a mathematical and classical training to their students, there remained certain faculties of the mind which had not been educated, and which had been scarcely touched. The students would have been scarcely taught how to observe and how to use their senses in interpreting their observations; and if no further instruction was given the mind might be actually stunted. Children possessed the heaven-implanted faculty of curiosity, and yet there was no doubt that when a little child was put between the four walls of a school, his curiosity was treated as a crime rather than a virtue. There ought to be teachers who were able to answer the questions of the little beings whom they taught, and who would not tell the children that it was naughty to ask questions. It was only the well-taught and sympathetic teacher who could properly deal with a child in this respect. It was very easy to train the memory and to cram a certain amount of knowledge of words into it. He did not depreciate the study of grammar, for he thought that it was a splendid logical exercise; but he believed that too much attention was paid to it. He had had a little experience of the difficulty of getting any large system of

natural science teaching. There were throughout the country classes connected with the Science and Art Department, but he thought that the work had been placed upon false lines, and that the sciences had been divided up too much, and that the students had been encouraged to take up a single branch, and been led to think that by studying it they might become proficient in science. Such persons had become teachers and had taken advanced certificates, and hence there had been a very hard line drawn, and a very technical idea engendered of science teaching. They wanted to pass beyond such a state, but it was very difficult to do so. He had had some experience with regard to the training of pupil teachers in London. The London School Board had determined that, instead of their pupil teachers being taught as of old in the different schools to which they belonged, they should be gathered into different centres, and eleven centres had been formed in the metropolis for the purpose. The establishment of these centres gave a fine opportunity for improving our science teaching, and a course of lessons was drawn out so as to give the young teachers, not merely a knowledge of chemistry or of physiology in particular, but generally a scientific course of instruction, commencing with the Huxley Primer, and going on so as to include in the third or fourth year everything that was included in the South Kensington Course of Physiography, which was the widest of all the courses, and seemed to contain what was very important indeed for giving object lessons and a general notion of nature. They might consider, therefore, that the course included the whole of physiography, but it included more than that, for it included a greater knowledge of biology than was contained in physiography. Sundry other matters were also included. This course was to be followed and to be taught by the authority of the School Board in the centres which had been established for pupil teachers; but it broke down practically, through the opposition of the teachers and the pupils themselves. The pupils did not understand exactly the learning

of science. They wanted to get as many certificates as they possibly could from South Kensington; and therefore, although they were required merely to take up one subject for entering a training college, they thought that they would like to get up two or three, and try not only physiography, but chemistry and physiology, and many other things. As to the teachers, it was very easy indeed to get persons well qualified to teach chemistry or botany, or perhaps mechanics; but it was rather more difficult to get teachers who were fitted to teach physiography, and to give a general knowledge of nature. It was almost impossible to find such teachers. The teachers themselves had a great interest in going along those particular lines which were marked out in the South Kensington Syllabus. Hence, between the desire of the pupils to take as many certificates as they could, and the desire of the teachers to follow the established lines, the matter fell through to a great extent last year. The consequence was, that at the examinations the pupils were almost a failure. He was almost glad that that was the case. Almost all the students who went in for the different things failed, because they attempted too much. He meant to insist that in their next course they should carry out something which would give them a general knowledge of the world, and also enable them to get the certificate which they wanted by going in for physiography. It was stated in the paper that the teaching of chemistry or any other subject should be given as much as possible through object lessons and tutorially, and not by lectures. That was a very important observation, and he commended it to the consideration of the Conference. Of course for training purposes they required that the pupils should understand the processes of thought and not merely its results, and that they should be able to follow along those lines by which we had arrived at a knowledge of the composition of things and of the main facts of nature. He thought that they had in view brighter times than now existed, and that, under the direction of Professor Armstrong and others

who took the same views as he did, they would find that the study of chemistry and the allied sciences would be much more fruitful of results, both as regarded information, and what was better than information—the true and highest teaching of the mind.

The Rev. G. WEST said that he had been trying science teaching in the case of boys under fifteen for twelve years, and he found himself in many of the difficulties which Professor Armstrong had spoken of. In the case of boys of that age intended for the public schools and universities it was not possible to extend the science course to anything like the range which Professor Armstrong suggested in the earlier stages. But in every part of education, as well as in everything else, one must always bear in mind that the progress must be from the general to the special, and not from the special to the general, so that very little boys might begin with elementary physiography or physical geography. This was a subject in which they would take immense delight. Then, afterwards, the teacher must take up out of the vast number of the subjects any one or two for which he could find time. In his own case he found that botany and chemistry were the only two which were of much use. Biology was practically shut out for many reasons. Botany was useful in the early stages of the child's schooling. Pulling a flower to pieces always gave pleasure to a child, and it showed the child what the flower was made of, and taught him simple observation and classification founded on observation. He had been rather disappointed with the results of chemistry teaching. He tried, first of all, by starting simply with analysis, and giving the boys a good practical knowledge and getting them to know certain things by using them, without being taught much about them. The analysis of simple salts was not very lively for a boy, but to a certain extent it was very good training, though the amount of knowledge given in the end was not very large. Lecture teaching was not good. The small boys could not take notes. They were interested in looking at the

experiments, especially if they blew up, but they did not carry away a very valuable amount of knowledge; and when it came to reactions, or anything like arithmetical calculations, a difficulty was experienced through the boys not knowing enough of decimals or other fractions. He was quite sure that for his purpose such a scheme as that marked out by Professor Armstrong was the right one; but how was it to be got at? How were masters or boys already fully occupied with other teaching to find time to set up a number of experiments? If the pupil's knowledge was of the fragmentary, unco-ordinated sort, which such teaching would give, it would not tell at all in examinations; and, though it greatly cultivated general intelligence, yet, while examinations were what they were, the teacher must, to some extent, work in view of them. The teacher must choose one or two branches which were interesting, and object lessons should be given on those branches with a certain amount of memorial repetition. For a long time he went on the object-lesson principle entirely, and he got but small results. Then he set the children to learn by heart a certain number of dry facts, which served as pegs on which to hang their knowledge. It was quite true that things came before words, but the children's knowledge of words and of things must go together. They could only be taught to use their reason through their memory.

Mr. W. A. Watts, as a teacher of about twenty years' experience of the working of science classes, desired to say, in the first place, how thoroughly delighted he had been with Professor Armstrong's exposition of a better mode of teaching science generally than now prevailed, which mode he had illustrated by instancing the teaching of chemistry. He was persuaded that the mere teaching of science, without each problem being put to the student's own power of solution, did very little good; but there was one great and, as matters now stood, insuperable difficulty in the way of improvement, and that was what Mr. West had already hinted at, namely, the absolute necessity of referring all work to the results

of an examination. He did not hesitate to say that the method of payment by results had done more to introduce a mechanical mode of teaching science than any possible mode that could be adopted. He should be delighted for his chemistry classes to take up the plan suggested by Dr. Armstrong, but he would like to ask Dr. Armstrong whether he had taught a class in that way, and presented it to the Science and Art Department, and what grant he had got. Of course, it was all very well to say that a teacher should be superior to mere pecuniary considerations, but a teacher, like every other professional man, had to make a living. The subject of chemistry afforded perhaps the most favourable example of the style of examination which now prevailed. He scarcely knew any other subject besides chemistry which it was possible to teach at all practically. Taking the case of physics, were he to follow out his own wishes in the matter, he would not take a text book on electricity, but he would commence by instructing his students to set up an electroscope, and he would give them various substances to rub, and set them to perform a series of simple experiments, so that they might trace out practically some of the very simplest laws. He should expect at the end of the session that each student might have mounted an electroscope, some form of galvanic battery, and an instrument for the measurement of resistances. But if he presented those students to the Science and Art Department, should he get one single pound in payment for his work? He believed that he should not. He was firmly persuaded of it; and if any gentleman would show him that it was possible, he should be delighted to try. But, for the sake of his own interests, he dared not try such a method of teaching at the present time. The same thing held true with regard to the teaching of light, heat, and sound. He believed that it held true, in fact, of every subject except chemistry, metallurgy and botany. If they took the teaching in an ordinary grammar school, there they would meet with the same difficulty—of the examination not being adapted to the mode of teaching

which Dr. Armstrong had recommended. In grammar schools the salaries of the teachers were not so strictly dependent upon the results of the examinations as in public elementary schools, but they were dependent upon them to some extent, and the wishes of the parents had also to be considered.

Mr. CASTELL-EVANS said that, being Dr. Armstrong's assistant, he felt rather unwilling to say anything on the subject. He wished, however, to notice the remarks of two speakers who had spoken as science teachers. Dr. Watts had said that they must follow the South Kensington Syllabus in sound, light, and heat; but he (Mr. Evans) was able to say that they need not slavishly adhere to that document. For some years he had obtained fairly good results at the examinations, though he had adopted in physics a method closely analogous to that adopted by Dr. Armstrong in chemistry. If a teacher could manage to get in forty lessons in the year, and not attempt to teach the elementary stage of the subjects in less than forty, he might get fairly good results. He found that he could teach electricity, light, and heat, practically, in forty lessons; showing the students the experiments, and teaching them how the laws were deduced from the experiments. In the earlier months of his connection with Dr. Armstrong, they had a large number of boys from the Cowper Street Middle Class School, and the system was then only in the experimental stage; yet Professor Armstrong and himself, with only a youth to assist them in keeping the place in order, managed very well. Of course, they had hard work. The number attending the classes was usually about twenty or thirty, and they worked in one or two small rooms; and yet he should not be ashamed to pass round the note-books which the boys had written. These books were a credit to the pupils. The system in question had not been much tried, and he thought that the more widely it was tried the better the results would be. Of course, if teachers were dependent entirely upon the South Kensington Syllabus, and made themselves slaves to it, the science

teaching in the country would be, he was afraid, rather bad; but if the teachers would make up their minds that they would teach science in a rational way, they would be able, in course of time, to force the syllabus to come to a rational shape. He thought that that was the best way for teachers to treat elementary science teaching. The observing power of the pupils ought to be cultivated before they began experimenting themselves. The pupils ought to be trained in exercising their powers of observation, and in drawing conclusions from what they observed. He knew from experience that the method of teaching botany adopted by Professor Henslow was a most excellent means of training the purely observing powers of the boys. He believed that if the system described by Dr. Armstrong had a fair trial it would be found to be more advantageous, even in the matter of pounds, shillings, and pence, than the one which had been in use for years.

Mr. J. HOWARD, as an old science teacher under the Department, wished to add his testimony to the great value of the exposition which had been given by Professor Armstrong as to the teaching of chemistry. It struck him very forcibly that this, which might be called the analytical method of teaching as distinguished from the synthetical, was quite as capable of producing results at the examinations as the ordinary mode. He believed from what Dr. Armstrong had said that morning it must be patent to all who understood a little of the subject of chemistry, that all the facts about hydrogen and oxygen could be taught by those few experiments, and that all the questions which were likely to be set by the Science and Art Department could be answered by lads who had gone through such a course. The only point of difficulty with him was whether each young student would be expected to fit up a set of apparatus for such experiments as were made use of. There was a large amount of manipulative skill wanted in fitting up complicated apparatus like that which had been exhibited, amongst which was an elaborate arrangement which would require the supervision

of an assistant, and hence a very large amount of time would be taken up. But if the demonstrations were simply meant for the teacher to get up, and the apparatus was to be kept from one lecture to another, or from one course to another, the matter would be quite a simple one. He believed that they were too much in the habit of setting up the examinations as a bugbear. If they taught in a rational way, and took up a subject as a whole—as for instance physics as a whole, or natural science as a whole—they could afterwards go into particular subjects and carry the boys through the special course.

Mr. J. J. PILLEY said that he was forced to speak in consequence of what had been already stated. He wished to give his experience as a practical teacher of science upon the question of whether practical teaching paid or not. The discussion appeared to have resolved itself, from what Mr. West and Mr. Watts had said, into a statement that practical teaching did not pay. He was a young science-teacher, but he possessed a little experience which he had derived from teaching chemistry in the Charterhouse School of Science and in Alleyns School College of God's Gift, Dulwich, and he had some little knowledge of the results which might be obtained after a proper course of practical instruction when there was no examination pending, or no payment depending upon an examination. He had taught for two years at Alleyns School, and given science lessons to the first form of boys, of from seven to about eight and a half years of age. The lessons given there were of a practical character, and comprised chemistry, physics, botany and physiology. The lessons were what might be called object lessons, being given upon such things as a piece of granite, or chalk, or coal, or upon a magnet or a piece of loadstone. Only last year, before the vacation commenced, an examination was held in botany. It consisted in sending eighty or ninety boys into the fields and giving them a certain time to gather so many specimens. The specimens which the boys of the lowest form had to collect were such as

would illustrate various characteristics of leaves. In the second and third form the work was of a similar character, and was not built up upon any special syllabus except one of his own compiling. In the fifth and sixth forms they had to do special work for university examinations, and there the syllabus became very much restricted, being confined to chemistry, practical and theoretical, heat and botany. Those were the subjects for the examination. He prevailed upon the Governors during the last year to allow him to send up some of the boys to the Science and Art Department examination as a test of the work. Forty-eight boys of the fifth and sixth forms were sent up for the examination in chemistry, but they were not picked specially for the purpose. Of these forty-eight, fifteen obtained first-classes, and twenty-five second-classes, and the rest were failures. This was the result of two years' work, one of the years having been devoted to special science work. He mentioned these numbers in order to show that practical work did pay. On the average he gave two and a half hours' instruction per day in physical science generally. During the rest of the time he had to prepare the experiments for the day's lessons. The apparatus was taken from that which was used by Professor Armstrong at the Finsbury Technical Institute, and was all of the same simple character, and the experiments were performed by him with one of the senior boys as an assistant at the bench. Five boys were sent in to be examined in practical chemistry, and all obtained first classes. As far as he had worked out the system, he found that the teaching of practical chemistry and of botany, in a truly practical way, by making the boys do the work themselves, not only gave them a greater interest, but at the same time gave a satisfactory result at the examination. Of course there was very little time for this kind of work in an ordinary science class. The students came for one hour, and they were in a great hurry to be off at the end of the time. If the teacher was willing to give them an extra half-hour, many of them could not remain. In the ordinary theoretical class which

he had conducted at the Charterhouse School of Science, every lesson except the lessons on chemical arithmetic was illustrated by experiments. The experiments were performed very slowly, and they were repeated afterwards by those who were taking practical chemistry in the laboratory. About thirty-two lessons were given during the session in theoretical chemistry, being illustrated according to Professor Armstrong's method. Forty-three students went in for the examination in practical chemistry. The number of first-classes obtained in this case, where there was payment by results, was fourteen out of forty-three, and there were five failures. Out of fourteen first-classes there were four first-classes in the advanced stage. In the practical class the result obtained was 50 per cent. of first-classes in the practical examination. He mentioned these numbers to show that practical teaching would pay if it was properly done, even when there was only a restricted time to work in. Many of the students who came to the practical class in the evening were persons who were engaged in business during the daytime, and they did not come with fresh vigour and full of energy. He might mention one other fact to show his belief in practical teaching. He had taught physiology for five years at the Charterhouse School of Science, and he had taught it practically, although the Science and Art Department did not require that it should be so taught. The result last year was thirty-six students obtained first classes, or passed in the advanced stage in physiology, out of a class of fifty.

Mr. E. M. DIXON: I have listened with considerable interest to the remarks that have been made by the various speakers, as they have spoken from various standpoints and with various experience. They are almost all of them teaching under different conditions, and that fact has, of course, to be considered in connection with the opinions which they have formed. I believe that these discussions of ours are likely to be more valuable the more speakers adhere to the direct results of their own experience; and adopting my own suggestion, I wish just to say a few

words. In the school, of which I am the principal, we work a course of science instruction on the lines of the Science and Art Department. We do not work, however, with a set of detached classes, such classes being selected strictly with a view to what will best pay us in money; but we have adopted, during the five or six years the school has existed, that systematic programme of instruction recommended by the Science and Art Department for what are called Organised Science Schools. Into any criticism of that programme I am not going to enter at present, but, in order that what I have to say may be judged of properly, I had, perhaps, better indicate briefly what the nature of this organised course of instruction is. In the first year of it we teach the elements of mathematics,—by which I mean, the first book of Euclid with deductions, and a little algebra up to the end of simple equations with two unknown quantities, and pretty stiff arithmetic, — with physiography as an alternative subject for theoretical mechanics. In the second year we take up, according to the programme, what you may briefly call the elements of physics and the elements of chemistry, with the elementary stage of solid geometry on our way to technical drawing, and we carry our mathematics a stage higher. The programme, as laid down by the Department, perhaps expects us to do rather more teaching in the mathematical way than is usually possible for ordinary students, but, on the whole, the course so far prepares a pupil very well for the higher and more special studies of the third year. Referring specially to chemistry, I cannot say that I have any fault to find with the Science and Art Department's programme. The first year the boys are expected to have a certain amount of knowledge, theoretical as well as practical. I venture to say that our boys always have considerably more; and perhaps a proof of that fact may be found in this, that this year the whole class, nearly fifty strong, has passed first class. There really and truly is no particular difficulty in teaching the elements of chemistry at all. Our experience certainly is that it is one of the easiest subjects

to teach, only you require a great deal more than twenty lessons. One gentleman has said that you should have at least forty lessons. He is perfectly right; the more the better. It takes a great deal of teaching indeed to get boys of thirteen or fourteen years of age fairly to grasp the first notions of chemistry. We give a great deal of time to it in the first year, and in the two following years,—for we have always more or less students in the honours' stage as well—we feel the benefit of the labour spent in the first year. With regard to using it as a means of intellectual discipline, we regularly do that, and regard it as a matter of course. The why and the wherefore of the processes employed are carefully gone into. Remarks have been made about the taking of notes. That is simply a thing impossible to young pupils, and in consequence of that I wrote for my own school a little manual containing some four hundred questions, along with a number of short notes. All that the pupils do is to take sketches of the apparatus employed in the experiments and write descriptions of them. The boys are really able to do this, and I go upon the principle that they should be asked to do whatever they are able to do, and should be assisted to do that which they are unable to do. With regard to the special idea of teaching which has been thrown out by Professor Armstrong, there is no doubt that it is very good. Its strong point is the intellectual side, but we all know very well that there is no particular novelty about it, and that it actually is incorporated more or less into the method of teaching which every teacher employs.

Mrs. RICHARDS (Boston, U.S.A.) said that she should not have ventured to say a word before so many experienced teachers except that she believed in free trade in ideas, and that if one knew of anything which had succeeded one ought to be willing to say a word in explanation of it. Some had spoken of the difficulty of teaching chemistry, especially to young children and even to children of from twelve to fifteen; but it had in a measure been done in America,

and done apparently with success. She merely wished to give a hint as to the method. Professor Huxley said some years ago that he did not think that chemistry could ever be taught in public elementary schools because it was too "messy." In the schools in which she was interested they had been studying a good while to know how chemistry could be introduced. They did not dare to appeal to the School Board of Boston to introduce chemistry, but the introduction of the principles of chemistry had been quietly effected in a series of "Lessons on Minerals"; and the plan had been very successful. Simple substances were first taken, beginning with metals. Dr. Armstrong had said that we somehow knew that iron was iron. Perhaps that was sometimes the case, but young people might not know it. She was very much surprised some time ago to find a jeweller asking what was the difference between lead and zinc. In these lessons on the metals each child was supplied with a specimen of the metal and could have it upon his desk. For a class of sixty about twelve hundred specimens, sixty of each kind, were prepared and were kept in boxes, and at the beginning of a lesson the specimen to be studied was placed before each child. Then questions were asked about the specimen in hand, such, for instance, as "How do you know that this is lead?" A class had never been found in which the children could not give eight ways in which they could tell that lead was lead, and was not anything else. Then, passing from the metallic elements, experiments were made by the teacher with oxygen (which was simply prepared in a test tube), for the purpose of showing that it was different from any other gas, but the teacher did not talk very much about it. She simply gave the children first some idea of the elementary constituents of matter, and then of the simple native compounds. In this way the children acquired a good idea of chemistry as well as of minerals.

Miss DILYS DAVIES said that she had had some experience of the teaching of chemistry in the North London School for Girls. The teaching had been limited to the

5th and 6th forms, and bore upon the matriculation examination, but in the future it might be extended to other classes. The teaching had been of a very practical kind, but not completely according to the method described by Dr. Armstrong. In the second term the girls were required to perform experiments themselves, but they, as a rule, did not get more than one year's instruction in the subject. Last year, as a matter of curiosity, the school sent up twenty students for the Science and Art examination. About eighteen of these passed in the first class. The teaching had not been specially directed towards that examination, but was simply of the character of the ordinary practical teaching which had been going on during the year. She found that chemistry might be introduced incidentally in the teaching of physiology and botany. The chemistry of the atmosphere, for instance, should naturally be introduced in connection with both those subjects. The teaching of botany had also been practical. It was commenced at the age of seven, and was carried on throughout the school course. The children were required in every stage to describe the plants, each child being furnished with a specimen. As the children grew up they continued to be practically taught, and ultimately they came to classification. She had not found it necessary to set the children to learn the tables of classification. The schedules drawn up by Professor Henslow, in which the main points of description were noted, had been found to answer every purpose. As the children advanced the schedules were filled up, but nothing was inserted in them which the children had not discovered for themselves. The technical names of plants had been introduced gradually as they were required. The familiar names had been used at first, and the botanical names were afterwards given. In that way a good deal of philology and etymology had been incidentally introduced in the teaching of botany. Last year, forty candidates from the 4th and 5th forms were sent to the Science and Art examination, and of these thirty-nine passed—about twenty obtaining first classes. The teaching had not been carried out with any special reference to the examination.

Mr. E. B. LETHBRIDGE said that as the master of a Board School, and a science teacher for 12 years, he believed it would be impossible to get the boys to fit up the apparatus required by Dr. Armstrong's method, and a staff of teachers could not be afforded for the purpose. He therefore thought the method would be "unworkable." He believed that the great defect of the Science and Art Department was not so much the syllabus, as the system of payment by results; and he believed that that was the general impression. Dr. Gladstone had bewailed the failure of the attempt which had been made by the School Board to introduce a practical system of instruction for pupil teachers. But that failure must not be attributed so much to the pupil teachers, or to the science teachers, as to the abominable system of payment by results. That was at the bottom of the mischief. The greatest boon which Dr. Gladstone could confer upon the teachers would be to hammer at the Department to induce them to abolish that system, and give a capitation grant, or something analogous to a capitation grant, instead. Payment by results was the great drawback. A teacher must make a living by his profession, and he could not obtain a living from the Science and Art Department, if he gave much time to practical teaching. He believed that the system of payment by results was not to be met with in any foreign country.

Professor GARNETT (Nottingham) said that in a reaction from a faulty method, there was always a danger of going to an extreme in an opposite direction. They were not talking of the technical education of chemists, but rather of giving a thoroughly sound elementary knowledge of chemistry to ordinary students. He agreed with almost the whole of what Professor Armstrong had told them, but he did not think that the method of practical teaching which he had so ably explained, could be put in the place of the ordinary lecture. He believed that by a combination of the two methods they could get over, in part at least, one of the difficulties which Mr. West had pointed out. He

had found it useful to give a lecture in which the chief experiments were such as those which Professor Armstrong had explained. These were elementary experiments which they could expect the students to perform. Then, having arranged all the apparatus for his lecture, there was no trouble in leaving it for the students to work with afterwards, during the next 2 or 3 days, so that they might repeat the experiments which they had seen performed at the lecture. In this way the two methods were combined without an unreasonable demand being made upon the time of the teacher.

Sir THOMAS ACLAND said that he had been particularly struck by the remark of one speaker that for some purposes they wanted chemistry taught less in the synthetical way than in the analytical way. He wished to say a word on behalf of that class of persons to which he belonged himself, namely, farmers, or those interested deeply in the cultivation of land or the feeding of animals. The Science and Art Department did not help them in the least. They had Mr. Buckmaster going about the country telling stories and saying a good many things which amused people, but the farmers did not get much out of them; and it would be hard to get farmers to assemble together in the evening after a long day's work in the field, or a day's hunting, and go through a course of instruction like boys at school. But he had seen half-a-dozen intelligent young farmers assembled in the evening, after having set out their own hurdles and fed their own sheep, and instead of being told about gases and metals, and equivalents, and a number of other things which were put forward in books, and which did not touch practical men, they were told what a sheep was made of, and what a loaf of bread was made of, and what milk consisted of, and they worked backward till they got some elementary idea of the things they were dealing with. He thought that farmers did want something of the kind. They wanted the light of chemistry thrown upon their agricultural work, in such a way that it would get into the heads of practical people. He had not

very great faith in farmers deriving any amount of good from the teaching of abstract chemistry in schools. It was in vain to give practical people the whole laws of chemistry in a general course. He did not in any way underrate the value of chemical teaching; but still he thought that farmers wanted to have light thrown on their practical concrete work, and this at present they had not got. Professor Huxley's book on human physiology was well known, but he believed that there was no such book to tell them about the functions of sheep and bullocks, and pigs and horses. Such a book was wanted, and he desired to make that fact known. Several gentlemen had thought about writing one, but it had not yet been done.

The CHAIRMAN (Mr. Magnus): Before calling upon Professor Armstrong, I should like to be allowed to say one or two words upon the question that has been before the Section. In the first place, I think that we are very much indebted to Professor Armstrong for having brought this subject under our notice. The teaching of science in general, exemplified as he has exemplified it by the teaching of practical chemistry, is a question of very pressing importance; and seeing the nature of the discussion to which this question has given rise, I feel quite certain that it will prove to be of practical benefit to those of us who are teachers, as well as to those of us who are interested in the organisation of schemes of instruction. One very important subject has been incidentally brought under our notice, and that is the possibility of good science teaching on the system which at present prevails—that of payment by results. I think that it was Mr. Lethbridge who asked whether any similar system prevailed in any continental country. I have had an opportunity of visiting a great many continental countries, and of inquiring into their systems; and I may say that I have not met anywhere any system in which the results of science teaching, or of any other teaching, are paid for by grants on the successes of the pupils. I do not wish you to infer therefrom that it is an altogether bad system, for

the system of payment by results may, on account of some peculiarities in our constitution, be specially adapted to the people of England. I only wish to state that I have not found out that it exists elsewhere; and I think that if we were to look around at what has taken place during the last ten years we should also be inclined to say that the system has worked well. There is no doubt that it has been the means of diffusing a large amount of general science knowledge amongst those classes of our population to whom that science knowledge is valuable. Whether a similar dissemination of science knowledge would have been possible under any other system it is difficult to say; but so much has been done by the Department, and for this I think that we ought to be grateful to the Department. At the same time, for my own part I must own that I do hope that the time will come when some method may be adopted by which our energetic and hard-working science teachers throughout the whole country may not be dependent, at any rate exclusively, upon payment by results. What system can be introduced I am not at present prepared to say, but I do look forward to the time when that appetite for knowledge, of which our president so ably spoke in his introductory address, will, so far have permeated, not only those who learn and those who teach, but those rich persons whose duty it is to encourage teaching and to encourage learning, that manufacturers and merchants, will, by local efforts, aid in the payment of teachers, irrespectively of what they may gain by the results of examination. I look to local effort mainly, and not to any centralised system, to aid teachers in this important matter. There is one other question which seems to have come out from the discussion to-day, and that is whether the system of payment by results sufficiently encourages the practical as opposed to the text-book method of teaching science. I think that we may conclude from the discussion that has taken place, that conscientious practical teaching does pay in the end. Those teachers who will take the trouble to give practical lessons to teach well

and conscientiously, and to see that their pupils work out results for themselves in the manner indicated by Professor Armstrong, will find, when they send up their pupils for examination, that they do succeed at the Science and Art Department's examinations. I quite understand that it is equally true that teachers who do not teach conscientiously, and who do not give themselves that amount of trouble which is involved in such conscientious teaching, may be able to obtain, if not equally good, at any rate, very good results. But I think that we may conclude that in the Department's examination, whether it be in chemistry, or in any other subject, good teaching is attended with paying results. As regards the syllabus of the Department's examination in chemistry, some remarks have been made to-day. I ventured to suggest in my introductory address yesterday, that possibly a different method of teaching might be advisable for those who have had systematic instruction at schools, and for those who wish to gain some science knowledge as an introduction to evening classes; and I think we must all regret that in the syllabus of chemistry of the Science and Art Department, the subject of metals—a knowledge of which is so useful to artisans, and to those who are engaged in practical work—does not enter into the elementary stage of their examination. There are very many other subjects which have been referred to in the discussion to-day on Professor Armstrong's paper. I think that we should all attach very great importance to what he has said with regard to general instruction in science as a preliminary to special instruction in any one branch of science; and it would be well if such a subject as physiography were taught in all our schools as preliminary to the teaching of physics, mechanics, chemistry, or any other special branch of science. But, in order to secure that result, it is necessary to obtain very good teachers, and such teachers are not easily found. Until that is the case we must depend upon the more mechanical teaching which is unfortunately at present adopted. In

conclusion, I will only say this, that the educational value of science teaching has been most ably placed before the Section by the reader of this paper; and if we ever are to arrive at a time when science teaching is to take the place of the literary training our children at present receive, it cannot be until methods have been adopted for teaching science which shall yield the same mental discipline as has been for so many centuries gained from the study of the classical languages.

Professor ARMSTRONG, in reply, said that it was a source of great gratification to him, that some of the points which he had submitted for discussion had been so well taken up. He thought that this augured well for the future. With regard to the Science and Art Department, he hoped that it would be fully understood that what had been said by him had been in no way said in the form of complaint. He believed that that Department had done a very great work indeed in this country, and they could not too highly appreciate the services of those who had been at the bottom of the science teaching. All that he had done had been to criticise, from the outside point of view, the present requirements of the Department, and to indicate the nature of the change which it was desirable for them to make as soon as they found that the ground was fit for them. He was sure that they were only waiting for that. As he had already said, he did not believe for a moment that they were satisfied with their system; but at present they could not make much alteration. The very great difficulty that teachers were in at the present time, with regard to the introduction of any new departure in their system of teaching, arose from the influence exercised by the various examining boards; and the only way in which that influence could be modified was, of course, by discussions of this kind. As soon as it was known that teachers were adopting more rational methods, the examinations would probably be altered in accordance with them. He had been connected with the examinations of the Science and Art Department for the last ten years, and he had known

the results of more than a hundred thousand papers; and he was sure that, whatever the requirements of the Department had been, the good teachers had always met with very fair reward under that system. In many cases, no doubt, the material at the disposal of the teachers had been very bad, and even good teachers had been unlucky on that account. Of course the nature of the material must be taken into consideration; but those teachers who had had fair average material at their disposal had, in the long run, got their deserts. What was more particularly wanted at the present time was some system of examination more elastic than the present one, and which would enable the examiners to test the knowledge of students and find out when they were crammed and when they really knew their subject. That was the great difficulty in the present system of written examinations. It was perfectly impossible now to find out whether a man had only studied the subject for a few weeks, or whether he had properly studied it. The introduction of such a system as he had proposed would render that result impossible. He did not propose to put this system in the place of lectures. He merely proposed to supplement the lectures by means of this system, and to do very much as Professor Garnett had indicated. In giving an introductory course, he usually adopted the plan which Professor Garnett had described. He generally found that the result of attending a lecture was very poor indeed, and that the ideas obtained by the students were very vague. It was only when they came to repeat the experiments for themselves that they really got a proper idea of the subject. There was no difficulty in working a comparatively large class upon the plan which he had advocated. It would certainly require more individual attention on the part of the teacher, because the great feature of the system consisted in revising the note-books, in order to see that the experiments had produced the proper result. The great difficulty of the method lay in this work of revision. The difficulty of taking notes might be got over by the lecturer giving out

at the beginning of the lecture a series of questions and making the lecture an answer to those questions. That method operated very well with the better class of students, and they gradually got into the habit of taking good notes.

TECHNICAL EDUCATION.

By Professor W. GARNETT.

IN the following paper I propose to touch upon a few points which have come under my own notice, and not to attempt a discussion of the general question of technical education. Referring to the engineering course at the Owens College, Professor Osborne Reynolds stated that its object is to teach the student to "understand what he sees," while the object of some Continental schools "is to teach him to produce what he has not seen." All technical or technological teaching should commence here—in an attempt to teach the student to understand and reason upon what he sees. Technical education, therefore, in its highest, though most elementary phase, should commence in the nursery. The Kindergarten system, now so rapidly coming into fashion in English homes, will, if properly carried out, lay the most solid foundation for the more specialised technical teaching of later years. A toy is given to a child, and he is taught its shape, colour and some other of its more obvious properties. His eye is trained to form, his fingers learn a certain amount of mechanical dexterity, and he begins to master the elementary principles of design by making patterns, or imitating natural objects, in wool work or coloured paper. By such means, at the age of three or four years, his education may be fairly commenced, without fear of overtaxing his mental powers. A little later, and the "object lesson" calls forth his reflective faculties. A familiar object is placed before him, and he is asked to state all he can think of which can be predicated respect-

ing it; thus calling forth his powers of observation and invention. The toy-makers have been said to be the finest mechanicians in the world; and the elements of kinematics, of machine design, and of building construction can be taught by well-selected toys as easily as by the most expensive models or machines, while their not unfrequent fracture "points the moral"; and while it shows the child the effects of defective construction, at the same time it gives the teacher the opportunity of showing how, by proper attention to mechanical principles, the calamity might have been avoided. Let there be more toys and fewer books in our elementary schools, and, by making a right use of them, our children will become mechanical engineers without knowing it.

The first requisite in technical education is that the child should learn to *observe;* and then to *think;* and to observe and think with accuracy. It may be that thinking is possible without language, but there is no doubt that language is a great assistance to accurate thought. Similarly, it may be possible to make observations with tolerable precision, and even to remember the results of such observations with a certain amount of accuracy without formally expressing them in terms of units; but *measurement* is, at the least, a great assistance to accurate observation. In short, measurement is to observation what language is to thought. Either may exist without its companion, but cannot attain to any high standard; while its communication to others becomes all but impossible. The necessity for accurate measurement should, therefore, be brought before the child at a very early stage in his education, and he should be taught the principles of units, the use of the foot-rule and of other simple measuring apparatus, and the importance of expressing all his observations, as far as possible, in numerical measure, as soon as he commences the formal study of arithmetic. To count the number of revolutions made by a fly-wheel in a minute, or to measure the velocity of a fly in inches per second, as he crawls up a window-pane, is an exercise of great educa-

tional value, and calculated to develop habits of accuracy which will be invaluable in the workshop. There are many fitters and turners, and even foremen of machine shops, who can tell perfectly well, by inspection of the work, whether a tool is cutting at the proper speed, but have no idea of what this speed is in feet per second, or even of the *relative* speed of cutting different materials. Perhaps, instead of saying that there are many who are without this knowledge, it would be nearer to the truth to say that there are few who possess it. There is no reason why a child should not be taught to express dimensions in feet and inches almost as soon as he attempts to convey an idea of them by separating his hands. The comparison of masses by weighing, and the use of standard measures in determining quantities of fluids should be taught practically as soon as the child begins to learn his "weights and measures," and might, with advantage take the place of many of the antiquated "tables" which children are even now, in many schools, compelled to learn, as for example, "a pipe of port contains 126 gallons," &c. Taught to measure time by the clock, distance by the foot-rule, and to compare masses by the balance, the notions of velocity, acceleration, momentum, force, energy, and the methods of measuring these quantities, will follow naturally and in due course.

In developing the habit of measurement, the drawing-class comes prominently to the aid of the teacher. Free-hand and model drawing train the eye and the hand, but the drawing of objects (pieces of machinery or other things) from measurements made upon them and entered at the time of making, the object not being present when the drawing is executed, affords not only a training in drawing but developes the habit of making and recording measurements. But it does more, it affords a useful intellectual exercise in compelling the student to consider what particular measurements must be made to enable him to complete his drawing without again visiting the object. Apart from the additional interest which the learner is

likely to take in his work, very much may be said in favour of that system of teaching drawing, in which the pupil commences by drawing simple objects from nature and only begins to draw "from the flat" when he has attained considerable proficiency in drawing "from life." In the teaching of mechanical drawing, still more may be said against the practice of simple copying.

No one accustomed to accurate measurements can converse with workmen of ordinary intelligence without being struck by their powerlessness to give accurate information on any question involving quantities. The method of trial and error, with its consequent loss of time and frequent injury to material, is their sole process for solving all problems, and, when once solved, the solution is too often forgotten, and has to be re-determined the next time the problem presents itself. If technical education is provided, by means of evening classes, for those who are engaged in workshops during the day, it should commence by teaching the necessity for measurement, and this should be followed by lessons on mensuration. Without a systematic training in geometry, most of the geometrical propositions required for the mensuration of the ordinary surfaces and solids can be exhibited with sufficient clearness by diagrams and models, and mensuration can be taught from first principles and without the employment of empirical rules. (It will be found in practice that, in dealing with men who have received no early mathematical training, but have been accustomed to learn everything by rule, it is necessary clearly to distinguish between the *process* to be actually adopted, and the *demonstration* which shows the connection between that process and the fundamental principles of the subject.)

Whether we are dealing with the school-boy, or with the artisan in his evening class, the elements of mechanics should be introduced as soon as the ordinary rules of arithmetic and mensuration have been mastered. The laws of motion and the principle of conservation of energy should be the starting point in this subject, and the illustrations

should be drawn from practical problems with which the student is familiar, and not from the imaginary and impossible systems which furnish the majority of the examples in ordinary text-books on mechanics. The discharge of a cannon, the blow of a hammer, the motion of a railway train, and other familiar examples, will afford almost endless illustrations of the principles of mechanics, and though the results may be only approximately true in practice, because in obtaining them we have considered only *some* of the conditions of the actual problem, yet even such results are of more value than those deduced from the purely hypothetical cases in which the conditions are so simple that they can all be taken into account. At this stage it is important to call attention to the discrepancy supposed to exist between theory and practice, and to show that such difference exists only because all the conditions which obtain in practice are frequently not taken into account in theoretical investigations. To allow a boy to think that "theory" and "practice" are ever opposed to one another is fatal to scientific progress.

The subjects which have been considered up to the present require very few special appliances to enable them to be efficiently taught, whether the classes consist of school children or of working men. The usual drawing materials and a few simple tools for the construction or repair of models are all that are necessary. But in schools where a workshop can be obtained, the drawing lessons should be supplemented by such elementary instruction in the use of tools as will enable the students to construct the simpler geometrical solids in wood and metal, as well as joints of various descriptions, and models illustrating their lessons in applied mechanics and building construction. Whatever their future trades may be, such instruction cannot fail to be of value to every boy attending the upper classes of our Board Schools, and the workshop should be open to all who have attained a certain standard in the general work of the school.

The first two or three years after a boy has left school

are a time of special danger to his educational career. In most cases he will be considered too young to enter the higher technical schools or colleges, while school boards are unable to employ their funds in providing evening classes which will sustain the continuity of his school work. There appear to be two ways of overcoming this difficulty; either the higher technical schools or colleges should open their evening classes to boys of fourteen who have left the board school, or special evening classes should be started under private superintendence in the rooms and workshops of the board schools themselves, which could be lent for such purposes at a nominal fee.

In providing technical education for those who have left school, the requirements of each trade must, of course, be separately considered. In the Mechanical Technical Schools at Nottingham attention has been given mainly to the requirements of three classes of students.

In the first place there are those who, having received a fairly good general education, can devote the whole of their time to the work of the schools. For these there is teaching in mathematics, physics, chemistry, drawing, theoretical and applied mechanics, steam, machine and building construction, tools, applications of electricity to the purposes of lighting and transmission of power, iron and steel manufacture, telegraphy, &c. Classes in all these subjects are held in the evening, while many of them are held in the day as well. During the intervals between the classes the students are fully occupied in the workshops of the college. These shops comprise a carpenter's and pattern maker's shop; smithy and foundry with furnaces for brass and steel, and a cupola; and a fitting, turning, and erecting shop equipped with a plant of tools sufficient for the construction of a six-horse engine or a six-inch screw-cutting lathe. In addition to these shops there is an engine house and dynamo shed, and provision is made for an instrument-maker's shop. With these appliances the students are enabled to obtain a general knowledge of the principles of pattern-making, moulding, and founding, and to gain a thorough

acquaintance with the use of the ordinary machine tools, while they are simultaneously continuing their general scientific education, and are also being instructed by lectures in the principles which should guide them in the operations of the workshop. Of course the practical training which such schools can afford will never take the place of the discipline of a large works. Moreover, the special machinery which enables a large number of similar pieces of work to be executed in the cheapest way possible cannot be introduced, so that while the work of the shop may be done *well* it cannot be executed *cheaply*. But though the technical school cannot, and ought not to, *take the place* of the workshop which is conducted on purely commercial principles, it may with advantage be substituted for it during the first *two years* of a boy's apprenticeship. The student will then leave the technical school and enter the works with a wider and more intelligent acquaintance with the processes carried on in the several departments than he would have if he had spent the two years in the works themselves, and will also be better prepared to profit by what he sees and hears; while in the use of the tools he will probably be in no sense behindhand. Two years spent in the technical schools, and followed by three years in the works, will thus provide a far better training than five years spent entirely in the works.

It is sometimes recommended that the day students should attend the classes and lectures of the technical schools, but that, instead of working in shops connected with those schools, they should work in regular engineering establishments. The practical result of this would be to compel the student to attend all his classes in the evenings, for if he has regular employment in a commercial establishment he cannot leave his work to attend classes in the schools at any hour of the day, and even if this difficulty were surmounted a great waste of time would be involved. Besides this, the student cannot conduct *experiments* with the tools and materials of his employer. It is very important that the teacher should be able to illustrate his

teaching by means of the tools themselves, and not only to point out to his students the conditions under which work can be done well, but also to show them the effects of violating these conditions in different ways. For these purposes it is essential that the workshops should be attached to the school.

The second class of students consists of trade apprentices who can attend the schools only in the evening. For these students the lectures and classes are the important features of the school; but here again the workshops are useful to enable the teacher to illustrate his instruction. Besides this they afford the means of overcoming, to some extent, one of the greatest difficulties arising from the extreme division of labour now necessary in large works. Too frequently a trade apprentice is put in charge of a particular machine and kept at that work for an indefinite period, perhaps for life. Few workmen are enabled to obtain the general experience which will fit them to become efficient foremen. Not unfrequently candidates for Whitworth scholarships complain that they are unable to obtain the experience necessary to enable them to pass the preliminary examination in the use of tools which must precede the more thorough examination in their special trades. The fitter cannot learn to turn a bolt to gauge, while the turner can get no practice in filing a hexagonal nut. It is obvious that the workshops of the technical school can, in this respect, supply a widely-felt want.

The third class may perhaps be regarded simply as a higher grade of the second class. It consists of workmen, many of whom have obtained considerable proficiency in their art and are earning good wages, but who wish to study some special branch which they have had no opportunity of learning during their apprenticeship. For example, geometrical staircase-work and hand-railing, as well as some of the more difficult questions connected with roof construction, are sure to be popular subjects among carpenters if a well qualified teacher can be obtained. The special industry of any locality should of course be made

the chief subject of classes of this description. In Nottingham the class on lace machinery has been very largely attended.

There is one other feature which should form an important part of every provincial technical school, viz., a museum. This should comprise a collection of kinematic models, as well as of models and specimens illustrating applied mechanics, including the strength of materials, and one of the chief objects of the workshops should be the equipment of such a museum. Besides these exhibits a department should be devoted to specimens illustrating the history and development of the machinery employed in the principal local industries wherever these involve specialities peculiar to the locality. Such a local "patent office museum" may be of enormous value not only historically but in saving much of the time and thought which are often expended in re-inventing contrivances which have been patented long ago, and superseded by others better adapted to the end in view.

Finally, a very important feature of the engineering school is the testing department. Here the practice of making accurate measurements, the necessity for which has been constantly pointed out in the elementary school, may attain its highest development. Every workman and every apprentice should be encouraged to make as thorough an examination as possible of the mechanical properties of all the materials he employs, either for his tools or his work, and the results obtained with the testing-machine should form the basis of the instruction given in the class on machine design. There are many large manufacturing towns in this country in which no testing-machine exists. In such towns this department might become a small source of income to the college.

In conclusion, I cannot dismiss the subject of mechanical engineering without alluding to the very great service rendered to technical education by Sir Joseph Whitworth. The work of the City and Guilds of London Institute is constantly before our minds, and needs no mention in such

a paper as this, but it was in the very infancy of technical education in this country that Sir Joseph Whitworth recognised its claims by an act that still remains unparalleled in its history. By a happy combination the Whitworth Scholarships succeeded in the double object of inducing workmen to study the scientific principles of their trade and of inducing students to become practically acquainted with the operations of the workshop. The results obtained by Sir Joseph Whitworth are not to be gauged simply by tracing the history of those who have obtained scholarships, though this test would show an achievement which must far exceed anticipation, but were it possible to follow the careers of those who tried and failed, far greater results would become apparent. When the Whitworth Scholarships were first founded there existed in the Science Classes of the country a certain amount of machinery to enable the workman to study science. With the growth of technical education these facilities have increased and assumed a more practical aspect, and consequently the Whitworth Scholarships themselves have become more valuable to the country. One generation of Whitworth scholars has become the teachers of the next, and as the facilities for technical education become greater, instead of the larger institutions of the future eclipsing those of the past, we shall look back upon the gift of Sir Joseph Whitworth as that which in great measure has rendered these larger institutions possible.

DISCUSSION.

A MEMBER of the Conference said that he had heard of the splendid work which was done at Nottingham. The work which was done at the University College there was of the very highest credit and advantage to the town. The question of technical education had been so exhaustively treated by Professor Garnett, that it was really

almost impossible to add anything to what he had said. The classification that the writer of the paper made, struck him as being an extremely good one; and he was specially struck with what had occurred to him, and what the writer of the paper had pointed out so forcibly—the need of something for the instruction of the lad, between the time that he left school, at the age of about 14, and the time when he went to attend the higher classes, at the age of about 18 or 19. It seemed to him that what was wanted now was some further development of the evening school. That system was almost a dead letter at present, having been gradually dying out. The encouragement afforded by the Education Department had been very scanty. It seemed to him that they must look to the evening school for the purpose of filling the gap. He had listened with pleasure to Professor Garnett's paper, and he believed that it would be of value to everyone who studied it.

Mr. CLOUGH said that unfortunately engineering shops did not exist in all towns throughout the country; and, to his mind, no system of technical education could be perfect unless it was capable of being applied not only in Nottingham, but in almost every large town, even in agricultural districts. The author had recommended that boys should be taught to draw from nature before drawing from a flat copy. He (Mr. Clough) had had some fifteen years' experience in teaching drawing; but he had never yet found a boy who could work from a solid model if it was put before him first of all. Students might learn concurrently drawing from flat copies and from solids, and that plan could be followed usefully; but he disagreed with Professor Garnett in his recommendation that solid drawing should be taught first. He did not think that the Professor had attached sufficient importance to the highest stages of mechanical drawing. Let them take the highest stage of solid geometry, and some difficult, complex form of mechanical construction, and make the student apply his geometry to such particular mechanical complexity so as to show that he knows what he is about. That was one

of the Department's subjects which could be taken up in any technical school. The result, in point of appearance, was not attractive ; but as mental training such work had a very high place indeed. He failed to notice any reference whatever in the paper to applied art. He believed that the application of art in England was our weakest point. Englishmen were admittedly the best engineers in the world ; but the moment they attempted to apply beautiful forms they found themselves at sea. Some of the best engineering works of the day were exceedingly ugly things, although they might have been made beautiful structures without being altered in their structural points.

The CHAIRMAN (Mr. Magnus) : I should like to say personally how very much obliged I am to Professor Garnett for having brought this matter to our notice. I think that the last speaker has made somewhat a mistake in supposing that Professor Garnett intended to travel over the whole field of technical education. I venture to think that he has done well in limiting his remarks to the technical education that is being given in the University College, Nottingham, which he has taken so large a part in developing. His introductory remarks with regard to general preparation for technical education, and the final remarks, in which he deals in detail with the kind of technical teaching which has been given, and given with very great success, mainly owing to his exertions, in Nottingham, are, I think, very valuable indeed. What I think is the essential feature of the paper which Professor Garnett has brought under our notice is, that he has drawn attention to the place which workshop instruction should occupy in higher technical education ; and he has done this, not theoretically, but by showing the results which have been achieved since the workshops have been added to the college at Nottingham. I believe that University College, Nottingham, is one of the few institutions in this country in which workshop instruction is given to both day and evening studies ; and Professor Garnett has shown very fully in his paper what I do not think has

been brought previously under the notice of those interested in technical education—the particular value of workshop instruction to evening students, and the way in which the workshops may be rendered available in order to enable classes of evening students to obtain a better and more thorough knowledge of the industries in which they are engaged.

Professor ARMSTRONG said that he should like, with the permission of the Chairman, to call special attention to one point in the paper, and that was the prominence which was given to the importance of measurement. Measurement seemed to form a feature in this Conference. Professor Fleeming Jenkin, on the previous day, strongly insisted upon the importance of measurement in reference to physics; * and he (Professor Armstrong) ventured to do the same in reference to the teaching of chemistry.

Professor GARNETT, in reply to the discussion, said: There is only one remark, I think, which calls for special mention. Of course in Nottingham, applied art is a very important matter indeed which is very much taken up by the school of art there. It is not only a school of art, but a school of design. Since that school of art was started, the efflux of designs for lace fabrics has taken place in a reverse direction. Formerly we used to be always purchasing designs in Paris and Bordeaux. Now there are very few designs indeed which come into Nottingham from that direction, while some go in the opposite direction, and Nottingham designs are taken to Paris and other parts of France. As to the teaching of drawing, it may be that drawing from the solid by very young children is not feasible; but I believe that with those who have a certain amount of intellectual power, the teaching of drawing can be commenced by drawing from the solid.

[The Section adjourned until two o'clock.]

---

* See Section C, p. 16.

In the afternoon Colonel DONNELLY, R.E., occupied the chair.

ON A NEW METHOD FOR THE TEACHING OF SCIENCE IN PUBLIC ELEMENTARY SCHOOLS.

By W. JEROME HARRISON, F.G.S.,

Science Demonstrator for the Birmingham School Board.

THE desirability of imparting to children some knowledge of the principles of science is now so generally agreed upon that this paper will be devoted not to the argument that science-teaching is necessary, but to a description of a method by which it may be successfully and thoroughly carried out.

In the "Code" under which the system of Government Education is carried on in this country science is mentioned under two heads:—

(1) As a "class-subject" (optional) which may be taught to any or all of the seven "Standards" under which the children are classed, and

(2) As a "specific subject" (also optional) which may only be taken by the children in Standards V., VI., and VII. The specific subjects named are –

1. Algebra.
2. Euclid and Mensuration.
3. Mechanics.
4. Latin.
5. French.
6. Animal Physiology.
7. Botany.
8. Principles of Agriculture.
9. Chemistry.
10. Sound, Light, and Heat.
11. Magnetism and Electricity.
12. Domestic Economy (*Girls*).

Either one or two (but not more than two) of these specific subjects may be taken by a child. The course

in each subject is divided into three parts, so that a child must remain at school for three years in order to complete the study of any one subject.

The grants paid are at the rate of 1*s.* (for a "fair") or 2*s.* (for a "good") pass in class-subjects, and 4*s.* per pass in the specific subjects.

To be successful in a public elementary school any scheme of instruction must be based upon the conditions of the Code. To these conditions, as they now stand, the following exceptions may be taken:—

(*a*) The teacher is forced to choose between geography and science as a class-subject. He may take *either*, but he cannot take *both*. As a rule, he takes geography. It is to be hoped that in the future this restriction may be removed, and that a simple course of object lessons on plants, animals, manufactures, etc., which would fulfil the requirements of science as a class subject, will be given *in addition* to those lessons on geography which are really indispensable.

(*b*) The three years' course in a specific subject is too long, now that the child does not begin the study until it enters the Fifth Standard. Taking the case of the boys and girls presented for examination during 1883 in the Birmingham Board Schools, we find in

Standard	V.	1864.
,,	VI.	482.
,,	VII.	85.

Tracing back the 85 Seventh Standard children, we find that they are the residue of 427 Sixth Standard children of 1882, and of 1223 who passed the Fifth Standard in 1881. It would probably be better to reduce each specific subject to a two years' course, and to allow Seventh Standard children to be examined in the work of the *two* previous years.

Choice of Subjects.

In considering what science subjects to select from those named in the code, much will depend upon local conditions. Generally speaking, for boys' schools mechanics should be

chosen, and for girls' domestic economy. As a second subject in town schools, either chemistry or magnetism and electricity may be recommended for boys, and animal physiology for girls. In country schools, principles of agriculture for boys, and botany for girls will be found very suitable.

In the new Seventh Standard School, lately opened by the Birmingham School Board, there is an excellent workshop, fitted up with carpenter's benches, forge, lathe, etc., for forty boys. For this school I have drawn up a syllabus of a (proposed) new specific subject, entitled "Principles of Tools and Properties of Materials" (see Appendix, page 142).

Objections to Science-Teaching.

In time past three principal objections have been urged to the introduction of science-teaching into public elementary schools. These objections are :—

(1) *Want of qualified teachers.* The ordinary teachers and pupil-teachers of our schools have not, as a rule, the sound knowledge of principles and practised powers of manipulation which are necessary in order to teach science with power and effect.

(2) *Want of time.* To *prepare* for a science-lesson, and to properly *clean and put away* the apparatus, requires more time than our closely-worked school-teachers are able to give. Some have also urged that time cannot be spared from the study of the "three R's," in which they consider incessant mechanical practice to be necessary.

(3) *Cost of Apparatus.* To teach any science practically —and it should be so taught to be of any value—a considerable sum must be spent in the purchase of apparatus. Thus the apparatus required for the three stages of mechanics costs about £75, and for domestic economy £65, and this is a considerable expenditure for a single school.

The Itinerant Method of Science-Teaching.

A method by which the principal objections urged against science-teaching in elementary schools may be overcome, was suggested a few years ago by Prof. Huxley, and it is not the least of the many services which that gentleman has rendered to science and to education. This method has been carried out on a large scale, and with the most gratifying success, by the School Boards of Birmingham and Liverpool, and the object of the present paper is to describe the manner in which the work is done in the former town.

The principal features of the Itinerant Method of Science-Teaching are as follows:—

(1) A Science Demonstrator is appointed, who should combine a practical knowledge of school-work, and power to teach large classes with a thorough acquaintance with the branches of science which he is to teach.

(2) A "centre" is chosen in connection with some particular school, where a class-room may be set apart, or (better) a subsidiary building erected where apparatus can be kept and the experiments prepared.

(3) A hand-cart must be provided, into which the boxes containing the apparatus fit, and can so be conveyed from the science-centre to school after school by a strong youth. In this way one set of apparatus will serve for many schools. In each school department there must be a tressel-table, which should be placed in front of the class as the time for the science-lesson draws near. The hand-cart is brought to the school, the youth carries in the boxes, unpacks the apparatus and places it upon the table. Then the Science Demonstrator walks in and gives the lesson. Afterwards the youth packs up the apparatus in the boxes, replaces them in the hand-cart, and marches off to the next school.

(4) A time-table is drawn up showing the exact time at which the science-lesson is given at each school, and its duration (forty-five minutes will be found suitable). A syllabus of each year's course of lessons must also be

pepared (which should be distributed to the class-teachers and children), so that the subject may be gone through in a systematic way (*see* Appendix, p. 134). As a rule, it will be found possible for each Science Demonstrator to give four lessons per day, or twenty per week.

Each class should receive a lesson from the Demonstrator at least once a fortnight. At each science-lesson the ordinary teacher of the class is present, and takes full notes of the matter given. During the intervening week the class-teacher *recapitulates* the science-lesson, giving such additional or new illustrations as he may be able to provide. The children then either write a general account of the lesson, or answer three or four questions upon it, and the papers worked are submitted to the Science Demonstrator when he next visits the class.

It is plain that the Itinerant System fairly meets the objections which have been urged against the introduction of science-teaching on the grounds of want of qualified teachers, want of time, and cost of apparatus. It also secures systematic and continuous teaching throughout the school-year. The teaching is practical, and every fact or law is demonstrated experimentally. Wherever eight or ten schools are within a reasonable distance of each other this plan may be carried into effect. Voluntary Schools may combine with Board Schools (as is done in Liverpool) to secure the services of a Science Demonstrator, or small towns near to one another (as in Lancashire and Yorkshire, or in the Black Country), may unite for the same end.

Application of the Itinerant System of Science Teaching in Birmingham.

It was in June 1880 that I received my present appointment from the Birmingham School Board. Since that time the work in which I have been engaged has received the unanimous approval of the Board, but I ought especially to acknowledge the encouragement received from the

Chairman—Mr. George Dixon—from Dr. Crosskey and the Rev. E. F. M. McCarthy, and the valuable advice given by the able and experienced Clerk to the Board—Mr. G. B. Davis. Mr. W. Lant Carpenter early recognised the value of the system, and has done much in making its advantages public.

Three Assistants have since been appointed, with a Junior Laboratory Assistant, and two youths who work the two hand-carts which we now employ. The regular science staff thus includes seven individuals, whose salaries amount to £750 per annum. In connection with the new Icknield Street School an admirable laboratory has been erected at a cost (with fittings) of £1,450, including a lecture theatre to seat 80, a chemical laboratory and store-room, and a demonstrator's room. About £400 has been expended in the purchase of apparatus.

There are now thirty schools under the Birmingham School Board, attended by nearly 40,000 children.

In each of the 30 Boys' Departments Mechanics is taken as a specific subject by every boy in the Fifth and higher Standards; six Departments take Magnetism and Electricity as a second specific subject.

In each of the 30 Girls' Departments Domestic Economy is taken as a specific subject by every girl in the Fifth and higher Standards; three Departments take Animal Physiology as a second specific subject.

At the request of the teachers a few Fourth Standard children of exceptional ability are allowed to attend the science lessons, since it is found, not merely to do them good mentally, but to induce them to remain longer at school.

The total number of children now receiving instruction in science in the Birmingham Board Schools is, in round numbers:

Mechanics	2,400	Boys.
Magnetism and Electricity	300	"
Domestic Economy	1,800	Girls.
Animal Physiology	100	"

In the framing of the syllabuses (*see* Appendix, pp. 134–143) a wide interpretation has been given to these subjects; thus under the head of Domestic Economy as much elementary chemistry and physiology are taught as will enable an intelligent girl to comprehend the familiar facts of home life.

As a rule two science-teachers and two youths go with each hand-cart, so that the lessons to boys and girls go on simultaneously in each school. By this plan each hand-cart can visit four schools (eight departments) daily, while with a single teacher only two schools (four departments) could be visited.

The same lesson is given to class after class, throughout the week. It is previously very carefully prepared by the science teacher, is written out in full by him, and the experiments are tried over and the apparatus packed on Saturday morning, so that everything is ready for the start on Monday morning.

In each science subject there is but *one stage* taught in each school. Children entering on the subject join in at the second or third stage, as the case may be, so that all the children in any one department form one class, working at the same stage of the same subject. This plan simplifies the work wonderfully, and it is found in practice that the science subjects taken may be as conveniently commenced at any one of the three stages into which each is divided in the Code as at any other. Each stage stands quite by itself, and each may be considered in turn as forming an introduction to the other two.

Results of the Science-Teaching in Birmingham.

The visits of the Science Demonstrator have been welcomed both by the teachers and children of the Board Schools. The teachers have earnestly co-operated in the work, and much of its success is due to their efforts. With the children, the science-lessons have proved extremely popular. There is invariably a good attendance on the

day of the science-lesson. Among the boys, the half-timers then muster strongly, often getting leave to come in for that lesson only, and sitting with bare arms and rolled-up aprons, just as they have run from their work. In the same way, big girls, who cannot escape from tyrannical babies, beg leave to bring their charges into the class-room ; and I know of many a case where "mother" has been persuaded to change her "washing-day" because it clashed with the day of the Demonstrator's lesson in Domestic Economy. The teaching has evidently been carried home, for an irate landlord visited one school to "know what they meant by teaching children that his houses were not fit to live in!" the said houses being built "back to back," a practice the evils of which are pointed out in one of our Domestic Economy lessons. The large number of papers, essays, mechanical drawings, models of apparatus, etc., exhibited by the Birmingham School Board at the present Exhibition will give some idea of the results of the work and of the eager manner in which it has been taken up by the children. So far from the science-lessons having interfered (by taking up time which would otherwise have been spent on the three R's) with the ordinary school work, the unanimous testimony of the teachers is that the increased intelligence of the children enables them to do their Standard work more easily. The idea has been very prevalent that by incessant mechanical practice excellence in the "three R's" can be secured; but the fact is, that unless the intelligence be cultivated, no subject can be properly learnt. True education is culture of the mind, and mechanical acquirements have nothing in common with culture.

Applying to the matter the practical test of the Government Examinations by H.M. Inspector, the results come out in a very satisfactory way.

Year.	Number of Passes in Specific Subjects.	Percentage of Passes in the Three R's.
1878	121	81.3
1879	424	82.0
1880*	841	84.7
1881	1,724	88.4
1882	3,114	92.6
1883†	3,150	89.6

Another pleasing fact is the much larger number of children in the upper Standards. In 1879 (the year before the introduction of science-teaching) the percentage of children examined in Standards IV. to VII. was only 19·5; it is now 33·7.

The following extracts from the published reports of the Birmingham School Board prove that, in the estimation of those best able to judge, the teaching of science has proved a success.

1880.—"An important addition to the work of the Board Schools has been the introduction of experimental lessons in elementary science. A Science Demonstrator has been appointed, and has now commenced work."

1881.—"In June, 1881, the Board decided to appoint an Assistant Science Demonstrator. The lessons in elementary science had proved so successful and attractive, that it was felt to be unfair that such advantages should be denied to some schools while they were afforded to others."

"These science lessons are fully answering our expectations; the children are very attentive and much interested

* Science Demonstrator appointed, June 1880.

† Mundella Code introduced, by which Literature (in which 1,435 passes were made in preceding year) was removed from list of specific subjects. The general requirements of this Code being higher there was a slight drop in the percentage of passes for this year.

in the work; and in addition to the useful knowledge they gain, their general intelligence is being developed."

1882.—"The success of the science-teaching has been strongly marked, both by the papers worked by the candidates for the science scholarships, and by the greater development of intelligence shown in regard to other subjects."

"As the teaching of science in the Board Schools has now become exceedingly popular, and many of the children have made considerable progress, six scholarships of £10 each have been founded in connection with the Science and Art Department."

"Upwards of one thousand boys are now receiving admirable lessons in elementary science in the Board Schools, and the result of this teaching is little less than marvellous."

1883.—"The teaching of elementary science in the Board Schools has developed considerably during the year, the scholars taking great interest in it, and the results shown by the examinations, being such as to prove that the knowledge imparted has been largely retained."

"Two great steps in advance have been made by the present Board. One is the establishment of science classes. The remarkable success which has attended these classes has been frequently alluded to, and is generally known."

Science Scholarships.—Twelve Science Scholarships of £10 per annum have now been established in connection with the Science and Art Department. The boys who obtain these scholarships, together with an equal number selected as showing special aptitude for science, spend each Friday afternoon at the Science Laboratory in the study of analytical chemistry. All those hitherto examined have passed (and nine out of ten in the first class) at the May examinations of the Department.

There are also two valuable science scholarships by which boys may pass from the Board Schools to King Edward's Grammar School, and thence to the Mason Science College, their parents meanwhile receiving allowances of £15 and

£25 per annum for their support. These scholarships are very keenly competed for, the usual number of boys examined being over 200. The examiner, Prof. Poynting, M.A., of the Mason College, reports as follows:—

1882.—"Hardly any of the questions in my paper could have been answered without independent thought on the part of the candidates, and I had but very few answers showing a want of such thought. The boys showed that they had seen and understood the experiments which they described, that they had been taught to reason for themselves upon them, and that they were not merely using forms of words which they had learnt, without attaching physical ideas to them."

1883.—"The paper worked by the boy who stands highest on the list was an excellent one, and showed considerable power. The next five boys also deserve special mention as having done very good work. I think the general style of work sent in was very satisfactory. The average was not so high as last year, as the (third stage of the) subject was far more difficult, and the paper set was also much harder, but I think that quite as much ability was shown on the part of the candidates, and that the evidence of careful teaching was quite as strong."

Summing up the matter, the results which we hope to obtain from this science-teaching, and which indeed have already manifested themselves, are:—

(1) The general quickening of the intellectual life of the school.

(2) The imparting of scientific knowledge and method to children which will be useful to them in after life, and which will cause many of them to continue their science-studies in evening classes.*

(3) The discovery of children of exceptional ability, and their support by means of scholarships.

* The last Report of the Birmingham and Midland Institute speaks of the influx of youths into the Evening Science Classes—"The result doubtless of the science teaching now carried on in the Board Schools."

(4) The instruction of the school-teachers in scientific principles, which they may apply to the general work of the school.

Evening Work in Science.—The work done among the teachers, by means of evening science classes in connection with the Science and Art Department has been of an important character. The Birmingham School Board employs about 800 teachers, and it now provides education, by means of training classes, for about 450 (the pupil-teachers and uncertificated assistants). The growth of the science work in this direction will appear from the following table:

Year.	Number of Certificates obtained.	Number placed in the First Class.	Gross Grant.
1881	24	0	£18
1882	91	18	£108
1883	100	24	£124
1884	*173	33	£197

It is very important to Elementary School teachers to do well in science, since (by a regulation of the Education Department) those who have passed in science have a certain number of marks added on to those which they obtain for other subjects at the Queen's Scholarship and Certificate Examinations through which they all have subsequently to pass.

. Electricity and Magnetism has been taught to the pupil-teachers, and Physiography to the assistants.

When evening science lectures are given, however, no school-work can be done by the Demonstrators in the afternoon of the same day, as the time is taken up with the preparation of the experiments, &c., for the evening lectures.

The Board possesses an excellent Optical Lantern (presented by Messrs. R. and G. Tangye as a token of their

* Including 41 Certificates of the Advanced Stage, 10 of which were of the First Class.

appreciation of the science-teaching) and with its assistance the Science Demonstrator gives popular evening science lectures in the various schools, taking subjects such as will be likely to awaken the interest and increase the intelligence of the children, as, "Wild Animals in the Zoo," "The Star-lit Sky," "Two Days in London," "A Voyage to the Moon," &c., &c. Occasionally, on fine evenings, the elder children are shown the moon, planets, double stars, &c., through a three-inch achromatic telescope (refractor). These expositions tend to attract children to school, and to improve the regularity of the attendance.

Cost of the System.

The following rough balance-sheet for the year 1883–4 shews the very small cost at which the work of science-teaching is carried on in Birmingham.

	£	s.	d.
Receipts.			
Half of Government Grant on specific subjects . .	160	0	0
Grant from Science and Art Department . . .	200	0	0
	£360	0	0
Expenditure.			
Salaries	750	0	[illegible]
Interest on cost of buildings and apparatus . .	70	0	0
Renewal of apparatus and cost of materials . .	50	0	0
	£870	0	0

Net cost to the Board . . . £510 per annum.

As a penny rate yields £6000, it will be seen that the cost of this system, by which more than 4000 children, distributed over sixty school departments, receive regular and practical science lessons, amounts to only one-twelfth of a penny in the pound, or to £8 10*s.* per annum for each school department. It must be remembered, also, that the full benefit of the system has not yet been reaped, and that the grants will certainly continue to increase. Credit has only been taken for one-half of the grant for the specific subjects.

K 2

TEXT-BOOKS.

Failing to meet with works exactly suitable for the wants of the children, the science-lessons in Mechanics and in Domestic Economy have been written out in full, and are now published by Messrs. T. Nelson and Sons. Similar works on Magnetism and Electricity and on Chemistry are nearly ready for issue. Each work consists of three small volumes corresponding with the three years course prescribed by the Code. These books have already been adopted by the School Board for London, the Irish Intermediate Education Board, and other important educational bodies.

SCHOOL MUSEUMS.

For use in object-lessons, and as a constant source of pleasure and instruction, a small collection of typical objects stored in a glass-fronted cupboard ought to be placed in every school. Such cupboards are now being supplied to the Birmingham Board Schools, and it has naturally fallen to the lot of the Science Demonstrator and his staff to assist in the mounting, naming, and classification of the objects with which the cupboards are, at little or no expense to the Board, to be filled.

CONCLUSION.

Since the commencement of this system of practical instruction in science in Birmingham, many eminent men have visited the schools to see it in operation, and they have been unanimous in their approval. In the "Instructions to Inspectors" issued by the Education Department, the system receives official sanction and commendation—"You will often find that these (specific) subjects are most thoroughly taught when a special teacher is engaged by a group of schools to give instruction in such subjects once or twice a-week, his teaching being supplemented in the intervals by the teachers of the school."

The Commissioners for Technical Education visited the Icknield Street Science Centre a few months ago, heard science-lessons given, and examined fully into the work. In their valuable Report, recently issued, they say: "We could hardly overstate our appreciation of the value of the plan of giving instruction in natural science by special teachers as carried out in the Board Schools of Liverpool and Birmingham, where the employment of a well-qualified Science Demonstrator ensures the sound character of the instruction, whilst the repetition of the lesson by the schoolmaster enables him to improve himself in the methods of science-teaching."

Within the present month (July, 1884) the work at Birmingham has been crowned by the opening of a Technical School for Seventh Standard Boys, situated in the centre of the town, and fitted with an admirable laboratory (for forty boys), lecture-theatre, workshop (for forty, with three lathes), room for drawing, class-rooms for the ordinary subjects, and a capital dining-hall, &c. The building has been adapted, fitted (at a cost exceeding £3000), and presented rent-free to the Board by Mr. George Dixon. This school will constitute the last link of the chain of elementary education supported by the town, and who can doubt that in it will be laid the foundation of many a good work, both for the individual and the community?

APPENDIX No. I.

BIRMINGHAM SCHOOL BOARD.

1884.

INSTRUCTION IN ELEMENTARY SCIENCE.

Method of Instruction.

The Science Demonstrator for the Board (or an Assistant Demonstrator) gives one lesson fortnightly, of about forty minutes duration, to the boys and girls in the Fifth and higher Standards in each School; these lessons are illustrated experimentally with apparatus carried from School to School in a hand-cart.

Between the visits of the Science Demonstrator, at least one lesson is given to the same Class by the Teachers of each School (as a rule by a Teacher who was present at the Demonstrator's lesson, and who took full notes of it), and a written examination in the subject-matter of the lesson is also held. The answers are corrected by the Teacher of the Class, and submitted to the Demonstrator at his next visit to the School. A General Examination in Elementary Science is held yearly.

BOYS' SCHOOLS.

Syllabus for Mechanics, or Elementary Natural Philosophy, as defined in the Fourth Schedule (Specific Subject, 3 A) of the New Code, 1883.

First Stage.

"Matter in three states; solids, liquids, and gases. Mechanical properties peculiar to each state. Matter is porous, compressible, elastic. Measurement as practised by mechanics. Measures of length, time, velocity, and space."

Note.—*Instruction in this subject should be purely descriptive and experimental*

Syllabus of Fortnightly Demonstrations.

1.—Matter and its indestructibility; elements and compounds;

three general properties of matter, viz.:—extension, divisibility, and weight.

2.—The three states of matter—the solid, the liquid, and the gaseous; some of the characteristics of each; fluids.

3.—Solid bodies; the force of cohesion; adhesion; powders. Structure of solids; molecules and atoms; crystals and crystalline bodies; amorphous solids; hardness of solids; alloys.

4.—Effects of heat on solids; practical applications; welding.

5.—Properties of liquids; viscous substances; surface of liquids; the spirit level.

6.—Capillary Phenomena; pressure of liquids; the diving-bell.

7.—Specific gravity of liquids and solids.

8.—Buoyancy of liquids; floating bodies.

9.—Effects of heat on liquids; the thermometer; conversion of liquids into solids and gases.

10.—Properties of gases; use of the air-pump; pressure of the air; the sucker.

11.—The barometer; its use in measuring heights, and as an indicator of change of weather.

12.—The siphon.

13.—Valves and pumps.

14.—Effects of heat on gases; winds.

15.—Porosity, compressibility, and elasticity of matter.

16.—Tenacity, ductility, and malleability of solids.

17.—Measurement of length, space, and velocity.

18.—Measurement of time; divisions of the day and year; sun-dial, clock, &c.

Second Stage.

"Matter in motion. The weight of a body, its inertia and momentum. Measures of force. The work done by a force. Meaning of the term "energy." Energy may be transferred but cannot be destroyed. Modern notions as to the nature of heat."

1.—Definition of "force"; the force of nature; differences between the physical force and the chemical force.

2.—The force of gravitation; the cause of weight; centre of gravity.

3.—Falling bodies; their rates of motion.

4.—The first law of motion; inertia of matter at rest.

5.—Inertia of matter in motion; friction.

6.—Mass and momentum.
7.—Representation of forces; composition of forces.
8.—The second law of motion.
9.—The third law of motion.
10.—Work, and how to measure it.
11.—Energy.
12.—Energy of matter in motion (kinetic energy).
13.—Potential energy.
14.—Principle of the conservation of force.
15.—Conversion of mechanical energy into heat.
16.—Conversion of heat into mechanical energy.

Third Stage.

"The simple mechanical powers, viz.: (1) the lever; (2) the wheel and axle; (3) pulleys; (4) the inclined plane; (5) the wedge; (6) the screw. Liquid pressure; the hydrostatic press. Liquids under the action of gravity. The parallelogram of velocities. The parallelogram of forces. Examples commonly met with illustrating the mechanical powers."

1.—Specification of a force; nature and action of machines; principle of work.
2.—The mechanical powers; conditions of equilibrium; the mechanical advantage; friction.
3.—The lever; parts of a lever; three orders of levers.
4.—Practical applications of the lever; double levers.
5.—Weighing machines; the balance; the steelyard.
6.—The wheel and axle; practical applications of this machine.
7.—The toothed wheel; clocks and watches.
8.—The pulley; fixed and moveable pulleys; the three systems of pulleys.
9.—The inclined plane; its principle and applications.
10.—The wedge.
11.—The screw.
12.—Compound machines.
13.—Pressure of liquids; surface of liquids; liquids under the action of gravity.
14.—The hydrostatic press.
15.—The parallelogram of forces.
16.—The parallelogram of velocities.

Recapitulatory lessons, in which general principles are illustrated by fresh experiments, are given as time permits.

GIRLS' SCHOOLS.

Syllabus for Domestic Economy, Fourth Schedule, Specific Subject, No. 10, New Code, 1881.

First Stage.

"(1) Clothing and Washing.
(2) Food; its composition and nutritive value."

Syllabus of Fortnightly Demonstrations.

First Year's Course.

1.—Matter and force; indestructibility of either; elements and compounds; the three kingdoms of nature.
2.—The human body; its general structure; functions of food; use of the microscope.
3.—Distribution of food by the blood; assimilation.
4.—Oxygen, and the part it plays in the animal economy.
5.—Hydrogen, and the chemical composition of water.
6.—Chemistry of carbon and carbonic acid.
7.—Nitrogen and air.
8.—Water as a food; regulation of the temperature of the body.
9.—Mineral foods.
10.—Amyloids, starch and sugar; their derivation and use.
11.—Composition, formation, and use of fat.
12.—Albumen and its various forms.
13.—Albuminoids.
14.—Composition of compound foods, milk, eggs, &c.
15.—Beverages and condiments.
16.—Adulteration of food, and simple methods of detection.
17.—Use of clothes; transmission of heat; the thermometer.
18.—Wool as a material for clothing.
19.—Cotton as a material for clothing.
20.—Characteristics of hard and soft water.
21.—Soap and soda; the skin.

Second Stage.

"The dwelling; warming, cleaning, and ventilation. Food; its functions."

1.—Meaning of the word *matter*: elements and compounds; the

three states of matter; the three kingdoms of nature. General structure of the human body.

2.—Composition and weight of the body; work done by and in the body; all work implies waste; how the waste of the body is repaired.

3.—Classification of foods; nature of the element, nitrogen; names, composition, and functions of nitrogenous foods.

4.—Characters of the elementary body, carbon; composition and functions of carbonaceous foods.

5.—Mineral food: water, air, common salt, salts of lime; their composition and uses.

6.—Materials of which the dwelling is built: bricks, mortar, slates, wood, iron, glass, plaster, paint, whitewash, paper-hangings, &c.; how these are made and used.

7.—Selection of the site for the dwelling; nature of the soil; construction of the dwelling and number of rooms necessary.

8.—Systems of drainage; use of pipes and traps; the germ theory of disease.

9.—Chemical composition of water; water can exist in three states, viz.: as a solid (ice), as a liquid, and as a gas (water-vapour or steam). Evaporation and condensation.

10.—Sources from which a supply of water may be obtained; rain-water, river-water, sea-water, springs, &c. How water may be stored for use; water-butts, tanks, cisterns, reservoirs, &c.

11.—Pure and impure water; causes of impurities and how to detect them. Construction and use of filters.

12.—Composition of the atmosphere, and its pressure on the earth's surface. The common pump.

13.—Products of respiration and combustion; how disposed of.

14.—Ventilation: the necessity for it, and the various methods by which it may be effected.

15.—Various kinds of fuel, their origin and use; how coal-gas is made.

16.—Effects of heat on bodies; construction and use of the thermometer.

17.—How to warm the house; grates and stoves. Warming by hot water or hot air, &c.

Additional lessons on the cleaning of the house are given by the class-teacher.

THIRD STAGE.

"Food: its preparation and culinary treatment. Rules for health: the management of a sick-room."

1.—Structure of the human body; names and positions of the various organs; structure of the skin; the teeth.

2.—Circulation and respiration; impure air and ventilation.

3.—The organs of digestion; the brain and nervous system.

4.—Nature of food; necessity for food; quantity required; classification of food.

5.—Preparation of food; meat: its composition and culinary treatment.

6. Fish, eggs, milk, butter, cheese: principles regulating their use and preparation as food.

7. Flour, pulse, peas, beans; their composition and preparation for the table.

8.—Starch, sugar, fruits, vegetables: their use as food.

9.—Condiments and beverages.

10.—Apparatus for cooking: how used.

11.—How to maintain the body in health: I. fresh air and pure water are needful.

12.—II., A suitable dwelling, sufficient food, and exercise (work) are also required.

13.—The sick room: duties of a nurse.

14.—Contagious diseases: their origin and treatment. How to prevent them spreading.

15.—Diseases of children: how to help the doctor.

16.—Accidents: what to do in cases of cuts, burns, &c.

Recapitulatory lessons, in which general principles are illustrated by fresh experiments, are given as time permits.

W. JEROME HARRISON.

APPENDIX No. II.

BIRMINGHAM SCHOOL BOARD.

Examination in Mechanics, 1884.

1.—What do you mean by the forces of *cohesion* and *adhesion*? Give examples of these two forces, which you believe to be in

action in the examination-room, with the reasons why you believe them to be present in each case.

2.—How would you try to prove that an iron rod expands when heated?

It has been found that a steel rod increases by about $\frac{1}{880}$ of its length if the temperature rises 100° C. The steamship Austral is built of steel, and is 470 feet long. How much will she alter in length in crossing the Atlantic if the temperature at Liverpool is 10° C., and at New York is 30°?

3.—How would you attempt to prove that a liquid exerts the same pressure on a small body immersed in it in all directions?

Describe and explain the action of Barker's Mill.

4.—Define *Specific Gravity.*

You are given a U-shaped tube, a foot rule, some oil, water, and mercury. Describe how you would find the specific gravity of the oil.

If you are given only oil and water, how would you find the specific gravity? State the method of proceeding carefully.

5.—Why does a body suspended in water require a less force to support it than when in air? How much less is the force?

A piece of brass weighs 73 grammes in air, but only 63·31 in water. Find the specific gravity of the brass.

6.—How would you prove that water expands more than glass when heated?

Describe the method of constructing and graduating a thermometer.

7.—Describe an air pump, and explain exactly how it acts.

If you close your lips and throat, you will find that it is difficult to move the tip of your tongue back from the teeth along the roof of your mouth. If you open your lips it is easy. Why is this?

8.—How would you make a barometer? Explain why the mercury stands at a higher level in the tube than in the basin. Why would not a water barometer act as correctly as a mercury one at different temperatures?

9.—A cubic foot of water weighs 997 oz. A glass bottle is found to weigh $25\frac{1}{2}$ oz. When filled with water it weighs 54 oz. Find its internal volume.

When a quantity of sand is poured into the bottle some of the water flows out. It is collected, and found to weigh 6 oz. Find the volume of the sand.

10.—How would you test whether any force acts on a body?

When do you say that work is done, and how do you measure it? What work is done by a man (1) in walking along a level road; (2) in climbing a mountain?

11.—What do you mean by a machine? What is meant by mechanical advantage? What are the real advantages secured in employing machines, from a mechanical point of view.

12.—State the relation between the power and the weight in the lever.

A plank 10 feet long projects with half its length over a table. A weight of 25 lbs. is placed on the end of the plank on the table. A boy weighing 50 lbs. walks along the plank from the table. How far will he go before the plank tilts over?

13.—Describe the construction of an ordinary balance.

I give you a foot rule, a ball of string, and a weight of 1 lb. How could you find exactly the weight of a body which was somewhat less than 1 lb.?

14.—A wheel and axle is used to raise stones on to a scaffolding. The radius of the axle is 2 in., while the power is applied at an arm of 8 in. A man exerts a force of 40 lbs. What weight can he just raise? At what part does he find it hardest to turn the handle, and why?

15.—Describe the second system of pulleys, where there is only one string. How many pulleys must there be in each block, if 1 lb. is to raise a weight of 10 lbs.? If the lower block weighs 2 lbs., what weight can be raised by a power of 1 lb.?

16.—Describe the construction of *one* of the following machines, and point out any simple machines which are used in it:—(1) Clock. (2) Tricycle. (3) Wringing Machine. (4) Crane.

J. H. POYNTING.

APPENDIX No. III.

BIRMINGHAM SCHOOL BOARD.

Bridge Street Technical School (for 7th Standard Boys).

New Code, IV. Schedule; Syllabus of proposed new specific subject.

PRINCIPLES OF TOOLS, AND PROPERTIES OF MATERIALS.

FIRST STAGE.—Tools used in carpentry and joinery: hammers and mallets; the principle of percussion; saws; action of friction, the axe, hatchet, and adze; spokeshave, drawing-knife, chisels, and gauges. Derivation of these from the wedge and inclined plane.

Nature of a plane surface; the jack-plane, smoothing-plane, and trying-plane. Use of the spirit-level and straight-edge. Boring tools, brad-awls, gimlets, augurs, bits, brads and drills. How they involve the principles of the lever and the inclined plane. Holding or grasping tools, including pincers and pliers; how they act as double levers.

How to hold and handle all the above tools.

Properties of materials used in carpentry and joinery.

Microscopical structure of wood. Origin of the "grain." The wood and the bark. Age of trees.

Nature and classification of the principal varieties of wood, including *ash*, *beech*, *birch*, *boxwood*, *deal or pinewood*, *larch*, *elm*, *oak*, *mahogany and rosewood.* Purposes for which each kind of wood is specially suitable. Veneers and their application. Specific gravity of wood; how it is determined.

Countries from which timber is obtained. The "seasoning" of timber; and the action upon timber of boiling water or steam.

Iron and Steel.—Wrought and cast iron. Production of steel. Varieties of *nails*, and derivation of the nail from the wedge. *Screws* and their derivation from the inclined plane.

Nature and use of *glue:* principles of cohesion and adhesion.

SECOND STAGE.—All contained in first stage, and in addition :—

The sharpening of tools; form of the cutting edge. The grindstone, whence obtained, use of water; action of fine

particles of matter on the lungs when inhaled. Emery and emery-wheels. Angle at which tools should be held. The oil-stone.

Origin and chemical nature of *rust*; its prevention and removal.

Joining pieces of timber; tenon and mortise; rebating; the dove-tail joint.

The Lathe.—Principles of turning; circular motion; names of the parts of a lathe and object of each. Tools used for turning; the angles at which they should be applied to the work.

Soldering.—Nature of alloys. Hard and soft solders, their composition, melting-points, and special uses. Preparation and chemical composition of soldering fluids. The Bunsen gas-burner.

Wood.—Computation of the cubical contents of timber. Prices of different kinds of wood. Easy problems on the strength of wood and determination of its breaking-weight.

Brass, Zinc, and Tin.—The properties peculiar to each, and the purposes for which they are generally employed.

Specimens of work done during the year to be submitted to H.M. Inspector by each boy. Any boy may be called upon by the inspector to practically demonstrate the use of any tool or appliance in the workshop.

The subject is divided into two stages only, as practically all the boys will pass through the school in the space of two years.

W. JEROME HARRISON,
Science Demonstrator for the Board.

DISCUSSION.

Mr. HEWITT (Science Demonstrator for the Liverpool School Board) said he had naturally taken a great interest in this paper, because some seven years ago he was appointed at Liverpool to work out a similar scheme, which was so far successful, that after it had been in operation three years, their Birmingham friends came and inspected it, and adopted it with the results which had now been narrated. But on one or two points he must say that his experience

did not altogether agree with that of Mr. Harrison, and especially as to taking the same stage of a subject with all the children in a school. He had tried that on more than one occasion, and found that the new children, who came in to join those who had previously had one or two years' work, found they were so far behind that they did not exert themselves to take any part in the work, but seemed indifferent when a question was asked, as if they considered that the others could and should answer, and they had simply to sit still. At Liverpool, at a considerable expenditure of time, they had kept the stages distinct, so that in each school there were three separate classes, one taking the subject for the first year, a second class taking up the second year's work (after having gone through the preliminary course), and the highest standard taking up the third year's course. Again, they had gone lower down into the school, and to this he attached great importance. They commenced in the first instance with the fourth standard, and had, up to the present time, continued working that standard, giving, in fact, the greater part of their attention to it. The children in the fourth standard were about 9 or 10 years old, and of course very little could be done in the way of producing direct results; but experience seemed to show that the preliminary work done in the fourth standard bore ample fruit when they got into the higher standards. Another matter which had not been referred to was the difficulty in showing the results produced, for as far as the examinations went they worked at a great disadvantage in having them all decided by written tests. These young children had to deal with the mechanical difficulties of writing, spelling and composition, and consequently were able to pay but little attention to the subject-matter on which they were asked to write; and yet on the answers to those questions the report was made. The inspectors themselves stated that the examinations they held did not sufficiently test the work which was done; and it really came to nothing but just an attainment of a rough basis for

the calculation of the grant. If they could have examiners who thoroughly understood the subjects, and—what was of equal importance to classes of children—who could come down and talk to them for a short time, they would be able to appreciate the success of the work far better than those who simply saw the written answers to a few questions. This system of science teaching was very admirable in its results, but he did not think it was calculated to be permanent. In visiting the schools once a fortnight, the children only got about one hour's instruction out of a total of 66 altogether, with anything additional that the teacher of the school himself might be able to do. It had been their endeavour, as far as possible, to enlist the teachers in the work. If they could only be brought to see the advantages of it, and adopt in their teaching the spirit and the methods of natural science, he felt we should get much more benefit from the science teaching than we could possibly hope to get from occasional lessons by a visiting demonstrator. The point especially to be looked to was the training colleges, where the teachers in training should have given to them every possible advantage, not merely for studying a subject from text books, or for working in a laboratory, but for instruction and practice in the manner of teaching these subjects to children. They should be encouraged to make apparatus for themselves, to prepare lessons and to give them to classes of children, and so be led to introduce the subject naturally into their work in the school. Figures had been given, and others might be given, to show the amount of good which had been done by this visiting system, but as the result of seven years' experience in the work, he thought it was only a temporary arrangement until they got teachers in the schools who could themselves do the work.

Professor ARMSTRONG said all who were interested in the subject of science teaching in schools must be much interested in this paper, and be very grateful for the efforts that were being made, but he must confess that a great weight had been taken off his mind by listening to the

last speech. He was glad to hear that it was not thought that this system would be very largely extended, or that it would become the system of the future. If science was to be taught at all, it must be taught seriously and looked at in a serious light; but if it were taught peripatetically, as it appeared to be in Birmingham, he feared it never would be looked upon in the proper light, or be estimated at its true value. A far more serious objection was that the teaching never would be practical. Mr. Harrison distinctly said it was practical, but he used the expression in a sense in which that term was not commonly used and understood, which was not the showing of experiments during the lectures, but work of a practical character done by the students themselves. It was this which was the most essential part in the view of most teachers of science.

Dr. GLADSTONE said, while he agreed perfectly with Professor Armstrong that this could not be looked upon as a permanent system for future adoption generally, yet it might be very largely followed with advantage by School Boards, and other educational institutions. Its not being practical might be got over to a certain extent by the means that were adopted at Liverpool and Birmingham: after the peripatetic teacher had given his lecture or demonstration, the teacher of the particular class expected to go over the matter with the experiments and illustrations. He feared that most of the apparatus would be carted away to some other place, and therefore he would be deprived of many very valuable adjuncts to his teaching, but still a school might have a good deal of apparatus of its own, with which the teacher might repeat the lessons given by the more qualified teacher who went round. He had had the advantage of seeing these lessons given in Birmingham, and was very glad that the matter had been brought forward as a plan adapted for the present time.

The CHAIRMAN (Colonel Donnelly) in proposing a vote of thanks to Mr. Harrison, said there seemed to be a considerable difference of opinion as to the value of this

method of teaching elementary science in schools; Mr. Harrison spoke very highly of it, whilst Mr. Hewitt did not seem to think it at all good; Professor Armstrong did not take a very encouraging view with regard to it, and Dr. Gladstone seemed to occupy an intermediate position. Under these circumstances, especially as he, the chairman, happened to be the originator of this system, he found it rather difficult to give an impartial judgment on the matter. It had been attributed to Professor Huxley, but it really arose out of a recommendation of his own to the chairman of the Liverpool School Board, who consulted him as to how he could introduce science teaching into their schools. He, the chairman, had urged the introduction of the teaching of science, but was met with the difficulty that the teachers in the schools did not know much of science, perhaps nothing, and there was no apparatus; if they got up a subject merely for the purpose of teaching it, it would not be likely to lead to efficient teaching. Any one looking into the matter practically, must see that that would be so; there were a large number of teachers in elementary schools who had no aptitude for science teaching, and knew nothing about it. No doubt if they did all know something of science it would be better, but they had to deal with facts as they were, and great numbers did not. Under these circumstances he was led to propose this system of employing an itinerant teacher, and recommended to the Education Department to make such regulations as would allow of grants being made for the attendances, etc. Professor Armstrong's objection seemed to be on the ground that it would be much better if the teacher of the school himself gave these instructions, because he would be more interested in it. Every one would agree with that; but the field of knowledge was large, and it could not be expected that elementary teachers should cover the whole of it. Even Professor Armstrong himself, in that Institution, took up only one branch, he did not pretend to teach all the subjects of science, which would be taught there; there must be some

division of labour. Looked at from a practical side, this system of an itinerant teacher did give a fair practical division of labour, and to a great extent met the requirements of the case. No doubt it was of very great importance to enlist the sympathy of the teacher of the school himself in carrying forward the teaching. Without that the whole thing would break down. That was a point he strongly insisted upon when he was consulted on the subject. No doubt the itinerant teacher would take away the general lecture apparatus, but it was quite possible for the teacher of the school, if instructed what to do and how to do it, to carry forward with some elementary apparatus, certain practical instruction before the next lesson. They could not expect to do very much at the present moment in that direction, because it was impossible to have a laboratory established in every school for children from the fourth standard upwards, and the itinerant system seemed to be a very good temporary expedient until they could get a better. A subject would be much more thoroughly taught by a specialist. And the lesson he gave should be afterwards gone over by the master of the school, acting as a *répétiteur.* Science teaching might, by that means, really be carried forward in a very efficient way.

Mr. HEWITT desired to explain that he fully believed that the system described was the best which could be adopted under the present circumstances. His object in saying that they must look to the school teachers themselves in the future was this, that something should be done in the direction of getting the teachers of elementary schools to do the work for themselves, and not to leave them under the impression that it would be well for it always to be done for them.

Mr. HARRISON said the chairman had replied so ably to the points raised by the different speakers, that there was very little left for him to say. Great stress had been laid on the co-operation of the school teacher, and he was glad to say that in Birmingham the teachers had taken it up

with very great pleasure; he could not have done the work at all without their help. It was quite true the system was not perfect, but it was very much better than nothing at all. How many School Boards would have introduced science teaching if they had had to buy the apparatus for each school? In Birmingham they would have had to spend £4,000 on apparatus instead of £400, and it would never have been done at all. In the matter of examinations they had had in Birmingham most efficient aid from Professor Poynting, of Mason's College, who examined the children yearly, in addition to Her Majesty's Inspectors, and a quotation from his report was given in the paper. He had found the same objection to the written examinations that Mr. Hewitt had pointed out, but it was impossible in the nature of things for it to be otherwise. He had often thought that in these specific subjects, if questions could be prepared in London for the whole country by the Education Department, instead of being set by each Inspector's assistant, it would be a great improvement. In the appendix to his paper would be found syllabuses of the subjects which were taught, and they would give a very good idea of the apparatus used. Each hand-cart held six to eight large boxes, and generally carried sufficient to give fifteen to twenty experiments at each lesson. The teaching was to some extent practical; for during the lesson he had children out of the class to assist in performing the experiments, and at the end of the lesson usually gave five minutes to selected children, asking them to repeat some simple experiment, and to point out and name the articles described.

SCIENCE TEACHING IN TRAINING COLLEGES.

By H. A. REATCHLOUS, M.A., B.Sc.

I HAVE been asked to write a short paper on Science Teaching in Training Colleges. This I have tried to do from a teacher's standpoint. I need not go into the history of the subject further than to state that, previous to 1878, science teaching in training colleges was quite optional, though in many cases it was taught under the patronage and superintendence of the Science and Art Department, and that twenty years ago there was neither obligation nor inducement to teach it at all.

Nor need I attempt to estimate the claims of various branches of knowledge to be taught in colleges and schools. It is for the authorities of the Education Department, who are thoroughly acquainted with the wants of the country, to consider what is most suitable for the nation at large. The last few years have been marked by increasing activity and progress in educational matters. Nor can this Exhibition of appliances, and this Conference on educational problems, fail to leave a deep and permanent impression on the minds of all. But that any further change in the Code of National Education must be in the way of substitution, not of addition, is a point upon which no English teacher entertains a doubt. If children are to be taught more drawing and science, less must be expected of them in spelling and grammar.

But while the framing of the Code must be left to the Education Department, it is quite obvious that the instruction a student should receive in college must be determined to a large extent by the use that is afterwards to be made of it in the primary schools of this country. He must know enough of the subjects he may be called upon to teach, to teach them efficiently. He

may do more, but he ought not to do less. And we must remember, that what is usually meant by science cannot be more than one subject out of many. The primary schools of this country can never become science schools exclusively or even mainly, and science teaching can only be carried as far as is consistent with subjects of equal, or perhaps greater importance. The special qualification of a teacher is ability to teach. Beyond securing this, it is not the business of the training college to make the students specialists in anything. They have undertaken to teach in elementary schools, and it is only as future schoolmasters that the training college has to do with them. It may be true that the demand just now for competent teachers of special sciences exceeds the supply. And it is probable that many teachers of elementary schools will hereafter conduct science classes. But that is not their main calling. Nor is it the duty of the training college to prepare them for such extra work as they may find time to undertake. It is plain therefore at the outset that the study of science in training colleges must bear a relation to that of the other subjects of the syllabus similar to that which the teaching of science in primary schools bears to that of the other subjects of the curriculum. Further, the considerations which determine the relative time to be given to science in a training college determine also the character of the instruction itself. If a man is to study many subjects, it follows that he must be content with an elementary acquaintance with them, and his knowledge can only be complete within well defined and restricted limits. A glance at the teacher's position will show that he has to do with science as an instrument rather than as a branch of education. He needs the fundamental conceptions, methods and results of science to enable him to explain allusions, to give lessons on the common objects and phenomena of every-day life, and, in general, to make his instruction stimulating and effective. Beyond this he may be required to give a systematic course of instruction in some one branch of science, but in very few cases will it have to go beyond the elementary stage.

To prepare him for this he certainly needs an experimental knowledge of one or two branches of science, but not such a training as would be required by one who was to make science teaching the object of his life. This seems to be the view of the Education Department. It has decided that a student can only study one science subject in the first year, and two in the second. The first year's men are examined in fourteen, and the second in fifteen subjects, each year over and above the so-called science subjects. The marks obtainable for science are about one-tenth of the whole in the first year, and a little more in the second year.

I shall not be far wrong in saying that a student cannot spend more than four hours a week on any science subject he may take up. The colleges may select in the first year one, and in the second year two, of the following subjects:—

(1) Mathematics.	(7) Agriculture.
(2) Pure Mechanics.	(8) Botany.
(3) Applied Mechanics.	(9) Physiology.
(4) Acoustics, Light and Heat.	(10) Physiography.
(5) Magnetism and Electricity.	(11) Hygiene.
(6) Chemistry.	

At the Westminster Training College the subjects chosen have been Chemistry for the first year's men, and Acoustics, Light and Heat and Physiography for the second. The colleges make their choice according to their special circumstances. There can be little doubt that Chemistry should precede Botany, Physiology, and also Physiography and Hygiene. Physiography is serviceable as including many of the subjects which deal with the experiences of every-day life. Hygiene and Physiology have important practical applications, and when Chemistry has preceded them, and suitable apparatus exists for teaching them, they would be valuable aids to a teacher.

Assuming, then, that experimental science must be taught as one, though only one, of many other subjects, the next question is how it should be done. In reply to this, I will state the course I have followed in regard to

the subjects of Acoustics, Light and Heat. I have used as a text-book Deschanel's Natural Philosophy, last edition, vols. i., ii., iii. A few other books have been mentioned, some to be consulted, and others to be specially avoided. I have not laid much stress upon lecturing, or taken much time with it, merely stating in as few words as possible the main points to be studied, and indicating where confusion would most likely arise. I have then referred them to their books, and spent the rest of the time either in what may be called demonstrating before the class, or in setting the men to repeat individually or in small groups the experiments which have been gone over in their presence. A few examples will make my meaning clear. Having stated that the rate at which sound travels in a wire depends upon the elasticity and the density of it, according to the formula

$$v = \sqrt{\frac{e}{d}}$$

I now proceed to show how the quantities can be measured in the case of any individual wire. The first thing is to get a clear notion of density. After pointing at the distinction between mass and weight, I refer to the principle of Archimedes. I take a small glass cube which happens to be exactly three centimetres in the side, weigh it in air, and weigh it in water, and show that the loss of weight is 27 grams.* Remembering that a cubic centimetre of water weighs a gram, it is seen that when weighed in water, a body loses exactly the weight of the water it displaces. The specific gravity of the glass is then obtained by dividing the weight in air by 27, which is the weight of an equal bulk of water. A specific gravity bottle is then weighed when empty, then it is filled with water and weighed again, and the weight of water it contains is then found. It is afterwards emptied and filled successively with ether, alcohol and sulphuric acid, and the weight that

* In these weighings the temperature of the water and the weight of the air displaced are disregarded.

it will contain of each is written down. Each of the results is divided by the weight of the water and the specific gravity of the ether; alcohol and sulphuric acid is thus found. After this I set the men to find the specific gravity of some common object not acted upon by water, and also of some common liquids. The apparatus remains in the room until every student has had the opportunity of doing this himself, or in conjunction with two or three others. The next time I pass on to the more difficult and generally less understood question of elasticity. Having hung up a piece of india-rubber and fastened a scale-pan to it, and pushed a needle through it for an index, it is then shown that the india-rubber elongates by an equal amount for the addition of equal weights. It is now easy to find how many millimetres the whole length is stretched by, say, twenty grams. We can then calculate how much one dyne would stretch one centimetre of one square centimetre cross section: this is of course a very small fraction indeed. The reciprocal of it is the important quantity called Young's modulus. We then find Young's modulus for a wire by stretching two wires from the same support, one carrying a scale and the other a vernier, which enables us to read to the tenth of a millimetre. We need in this calculation the sectional area of the wire. To get this a measured length of the wire is weighed in air, and then in water, and the loss in grams is observed. This number represents the volume in cubic centimetres, which divided by the length of the wire, gives the sectional area. If we substitute Young's modulus as expressed above in C. S. G. units for e and the specific gravity for d in the formula $v = \sqrt{\frac{e}{d}}$ we then get the velocity of sound in the wire in centimetres per second. We then stretch a wire across the room and alter the length till, when vibrating longitudinally, it gives out a note in unison with a tuning fork. We now know the number of vibrations per second, and the distance the sound travels for each one (twice the length of the wire), and we easily find

the specific gravity of the wire, hence we can calculate Young's modulus instead of determining it directly.

The course on light furnishes good examples of simple measurements as well as some difficult ones. All the men have compared the intensity of two lights by Bunsen's test or Rumford's, found the focal length of a convex and a concave lens, and measured the refractive index of a glass prism. For the latter purpose an ordinary spectroscope was altered so as to allow the telescope to move both right and left, and thus serve as a spectrometer. Having explained the principles involved in the calculations, and fitted up the apparatus in a room from which the light could be excluded, small groups of men observed for themselves, first, how to find the angle of the prism, and then how to find the minimum deviation of a ray of yellow light passing through it, and from these data calculated the refractive index of the prism.

My last example shall be that of finding the latent heat of steam. After explaining the apparatus and method, we proceed thus. The calorimeter is weighed. From its weight, and the specific heat of copper, we calculate the number of grams of water to which it is equivalent. The calorimeter is then about a quarter filled with water which is a little cooler than the room. It is weighed again, and the weight of water obtained. Meantime a flask of water has been fitted up with a bent tube, and when the water is boiling vigorously, the tube is made to dip well under the water in the calorimeter, the temperature having been taken just before. The water is kept well stirred, and when the temperature has risen, say about ten degrees, the steam jet is removed, and the weight of the calorimeter again taken, so as to find the number of grams of steam that have been condensed. The specific capacity of the thermometer is usually a small quantity in an experiment of this kind, but it is not difficult to find it. We have now all the data for determining the latent heat of steam.

These examples illustrate what I have regarded as the

most essential points to be kept in view. The most important phenomena have been singled out and studied at first hand, and as far as practicable, the quantities involved have been actually measured. This practical work is fascinating and suggestive; it leads to accuracy of observation, and soundness of judgment, and helps us to recall more effectively than anything else the methods that have been employed and the results that have been obtained. I wish to lay special stress on easy weighings and measurings, and it is because the subject of Acoustics, Light and Heat, furnishes so many good examples for practice, that I think it is very suitable for instruction in training colleges. There is hardly any school in which the knowledge thus acquired may not be turned to good account. Of course there is nothing original in this view of how science should be taught to adults, and what is valuable in it was learned in Professor Adams's Laboratory at King's College.

The other subject to which I wish to refer is Inorganic Chemistry. Here it is, if possible, even more necessary than in Physics, that the phenomena should be studied at first hand. But the multitude of facts to be observed is so great that it is utterly impossible that the men can do more than repeat for themselves a few of the most important experiments. For the rest they have had to depend upon lectures, which I have regarded as a necessary evil, for I am more and more convinced that Chemistry is not to be learned by listening to lectures, but by working in the laboratory. We have a laboratory at Westminster fitted up according to the requirements of the Science and Art Department, in which the men make simple pieces of apparatus, perform easy experiments, and study enough of qualitative analysis to enable them to take the advanced examination in Practical Chemistry. This part of their work is exceedingly popular. Towards the end of the year the laboratory is always open, and men often spend an hour or two there which they might have devoted to recreation. Last Christmas, of those who were examined

in Chemistry, 25 % were placed in the first class, 72 % in the second, and 3 % failed. Of those who also took the Practical Examination 56 % were placed in the first class, 35 % in the second, and 9 % failed. These figures will be a surprise to those who have read the sweeping condemnation of the science teaching in training colleges, on page 526 of the Report of the Commissioners on Technical Education. That condemnation is specially connected in the report with the failure of the students to satisfy the examiners in regard to the following question, " Write out the heads of a lecture to an elementary class, on the chemical and physical properties of water, mentioning the experiments you would show, and your object in showing them." " Heads of a lecture," would be a new phrase to the students. Most likely they would take it to mean " Notes of a lesson." They have been told that lecturing children is a bad and antiquated method, whether for conveying information or for mental training. What the examiners expected in answer to this question we are now able to judge, since they have recently circulated a detailed criticism of the papers, together with model answers of their own. The experiments which were to be performed in the model lecture were these :—

Exp. 1.—Decompose water by electric current, collect hydrogen and oxygen separately, and show that they are in reality oxygen and hydrogen.

Exp. 2.—Burn jet of hydrogen in jar of oxygen, dew is deposited on its sides.

Exp. 3.—Heat copper oxide in hydrogen, collect and weigh the water formed, and ascertain the loss of the copper oxide, which is the weight of the oxygen contained.

Exp. 4.—Heat sodium carbonate crystals in retort, and collect the water of crystallisation given off.

Exp. 5.—Show large quantity of water in milk, blood, or vegetable juice by heating in retort and collecting distillate.

Exp. 6.—Heat ice, it melts ; heat water, it boils and is converted into vapour.

Exp. 7.—Show that water when cooled contracts by a flask fitted with narrow tube and surrounding it by a mixture of ice and salt; with this the expansion just before freezing may be shown.

Exp. 8.—Show warm water boiling under reduced pressure—use air pump—or cool a corked flask filled with steam and water.

Exp. 9.—Dissolve salt or copper sulphate in water, and again separate them by evaporation.

Exp. 10.—Distil some natural water and test original water, and distillate with silver nitrate.

Exp. 11.—Water can dissolve gases, some readily as ammonia or hydrochloric acid—Show this, first opening the bottle in air to show that it is full of a gas; other gases, as oxygen, carbon dioxide, dissolve in small amount.

Exp. 12—Show the removal of the same by boiling a flask filled with water and fitted with cork and delivery tube.

Let me say at once that there is no experiment, except perhaps the fifth, with which the men ought not to have been perfectly familiar. But that a teacher should be expected to show all these at once to a class of children that had only had lessons on oxygen and hydrogen, almost exceeds belief. The object of science teaching in primary schools is, as the code so admirably puts it, to form habits of exact observation, statement and reasoning. This would require that these experiments should be thoroughly explained, that the children should state in their own words what they observe, and then reason about it, either tracing its relation to what they know already, or inferring that what is true in this case holds good for others like it, or in verifying the conclusions to which they may come. All this is quite incompatible with haste. Let it be remembered, too, that teachers in primary schools have only a limited supply of apparatus; much of it often home made, and no other assistants than their own elder scholars. To select a few points and teach them well, is all that is possible, and at the same time all that is needful. I under-

take to say that the trained teachers are very well able to teach what they know. In addition to the traditional and empirical knowledge which has been accumulated by generations of thoughtful men, thanks to Spencer, Bain, Robertson, Ward, and especially to Sully, they are now beginning to learn the logical and psychological ground for all that is best in their work. They have at present a more complete training in the practice and theory of education than any other set of men in this country—I think I might say, in the world. Two of the first five who took the new teaching diploma in the London University were students who had recently left the Westminster Training College, and scores of elementary schoolmasters would speedily do the same were it not that it is only open to graduates of the University.

I think it is only right to add that the syllabus for Chemistry is that of the advanced stage, and the department has announced that no student shall get a first class who does not get a good first class, nor pass at all unless he gets a good second.

I have not the figures for the country, but I give our own results for the last four years in percentages—

—	1st. class.	2nd. class.	Failed.
	per cent.	per cent.	per cent.
Theoretical Chemistry . . .	23	64	13
Practical Chemistry	58	37	5

These figures are hardly consistent with the Commissioners' report. Teachers, I think, may fairly ask why the men are allowed to pass like this if the work is bad, and why, if it is good, they do not get the credit of it. I do not mean to imply that there is not room for great improvement; there is. But I believe the improvement is only possible in the way I have indicated. Nor does it lie wholly with the teacher to bring it about. If we are to study the phenomena themselves instead of reading about them in a book, if results are to be measured instead of being taken

for granted, more time will be necessary as well as more apparatus, and more personal attention. In many cases the syllabus is too extensive, and in all cases it might be announced that a practical acquaintance with a few points would secure a pass.

There has hitherto been little inducement for men to learn more science than would get them a first class. Many of the best students who could make their mark in anything, spend most of their spare time in reading for a degree which they believe will be of service to them hereafter. If the time thus spent at Latin and Greek were devoted to Science, Art, or Modern Languages, it would be a distinct gain to the elementary schools. When young men see that distinction in these subjects bears directly on their promotion, they will not be slow to give more attention to them. But while it would be encouraging to have a few brilliant pupils, it must not be forgotten that it is not the exceptionally well informed, but the average teacher that goes into the small elementary schools of this country, and remains there. And if the authorities have come to the conclusion that our education has been too literary, that too much time has been given to the study of words, and too little to the study of things, they will doubtless put more science and drawing into the code, and make them a compulsory part of the school work. It seems desirable, therefore, that all the men should be encouraged to learn as much science and drawing as they have time and capacity for, so that they may teach them wherever they go.

The conclusions to which these remarks seem to lead us are :—

1st. That science can only be taught in training colleges as one of many equally important subjects.

2nd. That sound elementary instruction is being given in these institutions at the present time.

3rd. That the success of the students in Chemistry, and especially in Practical Chemistry, is inconsistent with the judgment expressed by the Commissioners on page 526 of their report.

4th. That further improvement must be sought in giving the men greater inducements to work practically at the subjects themselves, and study phenomena at first hand.

DISCUSSION.

Dr. O'REILLY said they had heard a great deal in the previous discussion about the peripatetic system of giving instruction in chemistry and physics, but he thought there would be no great diversity of opinion as to the propriety of there being in every training college an adequate equipment of instruments for a fairly good course of instruction in physics. It was impossible to make every teacher thoroughly efficient in a large number of subjects, but it was quite possible to make them fairly efficient in elementary chemistry and physics generally. The object aimed at in training colleges was not to form accomplished analytical chemists or able electricians, or specialists in any other branch of physics, but to so train the teachers that they shall be able to give an elementary course of instruction in all these subjects. It seemed to him that the rational system was to give the lectures first and afterwards ask the students to learn the same subjects from their notes and from good text books. The other method of making the pupil first learn from books and afterwards assist at lectures, was not at all to be recommended; the difficulties should be explained before requiring any study or memory work. He fully agreed with the author of the paper as to the importance attached to the determination of physical constants. It was all very well to talk to young men about the latent heat of steam, of specific gravity, of electrical resistance and such like, but experience showed that when these measurements were made before a class, there was always a much more thorough grasp of the subject. Nor did such determinations involve elaborate instrumental appliances; it was extraordinary what an

amount of good work could be done with simple apparatus. Every one knew what wonders Faraday accomplished at the Royal Institution and at Woolwich by the very simplest means; and though they could not pretend to be Faradays, they should try to obtain from commonplace apparatus the principal results it was capable of yielding. It also appeared to him quite the correct view to say that the object of science teaching in schools was not so much to impart an acquaintance with general phenomena, or even the laws of nature, as to form habits of exact observation. If the young men who were to bring up the youthful generation were properly trained themselves in a few branches of physics, the mental discipline they would thus acquire would enable them to develope their powers rapidly in other directions. It was said that teachers were expected to do impossibilities. Such a statement argued, at least, that there was a slight chance of improvement in those who had the direction of the educational methods of the country, more especially the examinations; and this improvement was a matter of no small importance for the educational prosperity of the country.

Dr. GLADSTONE said, as he had already expressed his opinion on a cognate subject, he would merely remark on the conclusions with which the paper terminated, and first he would take numbers two and three, namely, that sound elementary instruction is being given in these training colleges at the present time, and that the success of the students in practical chemistry is inconsistent with the judgment expressed by the Commissioners in their report. Now there were training colleges and training colleges, and there were teachers and teachers; and quite independently of anything which had taken place that afternoon, he had the means of knowing that the gentleman who had introduced this matter was a very good teacher, and they knew very well that the teaching of science in the Westminster Training College was carried on in a very excellent manner. But what was perfectly true with regard to that college was not true, unfortunately, with regard to all

training colleges. The Rev. Mr. Sharpe, had he been present, could have told them something about the deficiencies in some of the training colleges, and in his report to the Education Department he had pointed out most strongly how weak many of those training colleges were in the matter of teaching science, and had made various suggestions as to the way in which it might be improved. The first conclusion in the paper was that science could only be taught in training colleges as one of many equally important subjects. Now it appeared there were about fifteen of those important subjects, and he did not think anyone who had considered them would say they were equally important with science. He would not put science as the most important of all, and there might be one or two more important, but he claimed at any rate that it should have a great deal more than one-fifteenth part of the time and attention given in training colleges. It was wanted, not merely for the knowledge it gave, but for the training of the mind for training up pupils to understand something of the great world in which they were placed, and in which they must work. Those who were to be taught by these young men and women in the training colleges, were themselves to be the artisans of the future. Mr. Reatchlous himself stated that a larger amount of science teaching could only be effected by reducing some of the other departments, and he mentioned especially spelling and grammar. Now, both these things, as far as the great mass of the working men and women were concerned, were simply useless accomplishments. Of course it was necessary that they should learn, to a certain extent, to spell, although as far as mental development or training was concerned, instead of being good discipline for the mind, it was a bad one. It was not necessary to learn spelling according to the orthodox mode in the best printing offices, which were really the lawgivers in this matter. If they were content to spell as Shakespeare and Milton did, he thought that would be enough, and that would make an immense saving of time in elementary schools. With

regard to grammar, there were those present who could speak to that better than he could; but although admirable as an exercise, it was of no particular advantage in any respect, and it occupied a great deal of time. They ought to give the greatest amount of time to that which was the most important; and if that were the rule acted upon, science teaching would have a great deal more of time and attention devoted to it. It was stated that "further improvement must be sought in giving men greater inducements to work practically at the subjects themselves, and study the phenomena at first hand." He was exceedingly glad to hear this so prominently brought forward, not only in that paper, but in many others in that Section. He trusted it would always be borne in mind that for mental training it is necessary not to learn science from books, but from the things themselves. He trusted there would be a great advance of public opinion in that direction, that these discussions would be made largely known outside, and that the teaching of science in training colleges and elsewhere would become far more practical and extensive.

Mr. CASTELL-EVANS said the time for teaching science in training colleges was very limited; yet he thought that young men training for schoolmasters might well devote more time to science. Many of the young men who entered training colleges were quite capable of answering any question to be set at the final examination, in a great number of the fifteen subjects; and yet they were obliged to attend classes on those subjects during the two years. It struck him there was an excellent institution close by which might be taken advantage of, if the young men who were training for schoolmasters were able to pass the examination for certificates at the end of one year, and then had twelve months training in the Normal School of Science. There they would get a better insight into scientific methods of measurements and such like matters. If scientific teaching were to be of any use, it must be exact; and taking one instance which had been

given, namely, the weighing of a cube of glass, unless that were taken at 4° C., of course it would not be on an accurate balance near to the 27 grammes, and if students were allowed to do things in a slip-shod manner, they would teach in a slip-shod manner too. In the Normal School of Science excellent instruction was given, and he did not see why part of the two years' course of the college should not be spent there.

Mr. MANSFORD said one great advantage derived from the teaching of science in training colleges, rather than in separate institutions, was that they afforded opportunity for illustrating the results in the practising schools. The object with which a young teacher went to learn science was that he might be able to teach it, and it was equally important that that teaching should be superintended as that the instruction itself should be carefully given. In the training colleges not only were the specific subjects taught, but the students had an opportunity of shewing how they could teach what they had learned.

Mr. HOWARD said he knew something about the science teaching in training colleges, being himself a teacher of chemistry in the Borough Road College. He found the young men who were learning chemistry were constantly coming up during their first or second year, to know what illustrations they could best give in lessons—illustrating the point just referred to. He always gave them every encouragement by directing them what experiments were best to show a class of children, and also furnished them with the apparatus at hand. With reference to the question referred to, by the reader of the paper, as to notes of a lecture on the composition of the air, he could quite believe that students would not be able to furnish a list of elaborate experiments, and he never encouraged them to do so; he always pointed out to them that they had better use the simplest experiments possible before children, such as they would be able to do in their schools by and by.

The Rev. E. F. M. MACCARTHY said Dr. Gladstone had hit the key-note when he said that the Westminster Training

College and the Borough Road College, and one or two other London training colleges, were not examples of those which were educating the vast majority of assistant teachers in the country. As a matter of fact, the reputation and position of these London training colleges were such that they could command all the students who were really at the top of their profession so far, who had made good use of their time whilst pupil teachers, who had shown ability, and probably had had better opportunities of early education than most of those who were to be the certificated teachers of the country. The consequence was that these training colleges could place their students at the end of their time in the position of principals of some of the most important schools of the country. But the teachers trained in the smaller colleges had no such happy fortune in store for them. Most of these institutions had a dead weight to contend against, and however unpleasant it might be to say so, prominence should be given to the fact, because the object of the meeting was to probe to the bottom the difficulties in connection with the teaching of science in order to find a remedy. To begin with, these training colleges had very often to deal with a grossly ill-educated set of students. He did not mean to say that was their own fault; everyone knew the circumstances, and the condition of the market, which drove into the profession a vastly larger number of teachers than were really mentally qualified for the work, and these training colleges had to do the best they could for them. Consequently, such elementary subjects as spelling and grammar had to be included in the training college course. As a matter of fact, the pupil teachers went into these training colleges at the end of their four years' apprenticeship in such a backward state, that the authorities dared not neglect spelling and grammar for the sake of the most useful scientific subjects which could be named. Again, another point was the influence brought to bear in the training colleges themselves, owing to the peculiar character of those institutions. They were mostly denominational,

or diocesan institutions, and, as a rule, at the head of such a college there was a gentleman and a scholar—a university man very likely, educated at one of the public schools of the country, who had taken a classical degree at the university; but a man not in the least degree in sympathy with scientific teaching; he did not understand science himself, his whole life and pleasure in the direction of learning lay in a totally different direction, and he could not realise at all the position which Dr. Gladstone and others took up in the matter. The consequence was they had at the outset a principal who was not in sympathy with scientific teaching. Again, no teaching was so expensive as science teaching; it meant a number of rooms, which meant rent; and it meant a number of special teachers and apparatus; and all that really brought up the expense of these training colleges, which was always at the margin of discomfort, to a point beyond their means. This matter of expense really lay at the bottom of a great deal which was amiss at the present time. To meet the demand for science teaching the principals of these training colleges looked out for someone who had passed in the Science and Art Department, and he was told to prepare himself to teach chemistry and science, and he did so to the best of his ability. He prepared some very good notes, wrote them out in a clear form, passed them down to the students, and they copied them, and when they left, they handed them on to the students who came after; and so it went on *ad infinitum*, and that was really all that was meant by science instruction in most of the training colleges.

Sir HENRY ACLAND, M.D., said if it were not out of order to make observations on the remarks of previous speakers, he would ask leave to say a word or two on what had just been said. He did not think it right by the University to which he belonged to remain silent, when he noted the tendency of the remarks made by the last speaker that the Principal of a training college, because he was a University man, was out of sympathy

with the progress of science. No doubt it might be so, and he did not at all question that such was the personal experience of the gentleman who had spoken, but it was not his own experience nor his observation. Indeed, when being examined several years ago before one of the Royal Commissions to inquire into the general education of the country by the late Lord Clarendon, his Lordship made this observation rather in the form of a question, "If science is to be taught in the schools of the country whence are the teachers to come?" and to that he gave the reply that the fact that there would be such employment in future for the young cultivated men of science in this country was a great relief to his mind, because he found that the old universities—Cambridge, to which he had not the honour to belong, especially—and his own university, Oxford, also—twenty years ago were training many persons with the deepest sympathy with the highest departments, and the most rapid advance, of science. Therefore, he felt that in schools of all kinds, in the great public schools, and also in other schools throughout the country, and in the training colleges there would be an opening for these young men. He felt it his duty to say this much because whereas twenty years ago, when earnest natural science teaching began in Oxford, there were only two men who passed, none being thought worthy according to the standard then set for honours; but in this last year, if he mistook not, there were twenty-five men who took honours, and over thirty who passed in a very considerable standard, both in theoretical and practical teaching as pass men. Therefore, a University, which had been supposed to do nothing for the science of the country, was, over and above its complete Art training, at this moment training over thirty young men per annum, most of whom would be quite fit, according to the education received from such Professors as Clifton, Moseley, and Burdon Sanderson, to be teachers in schools. He was glad to be permitted to say this much for another reason, because it enabled him to observe, in entire confirmation and respectful approbation

of what had fallen from Dr. Gladstone, how entirely what he had stated had the fullest sympathy in the universities, namely, that, in the present condition of human knowledge, to put the whole range of study of the laws of the material world on the same level with any other dozen subjects which were named as very valuable in certain parts of education was an anachronism, and that all men of intelligence knew and admitted this. It was right also to add that in his judgment there was no such thing as true teaching of natural science in any department, whether organic or inorganic, whether in the biological or the physical department, except that which was in some measure practical. The theoretical part was necessary; but without the laboratory and practical work there could be no real progress either for teacher or for the student. It was only respectful and right to say this within the walls of a great institution, which held in its hands no doubt a great deal of the progress of education of this country in most modern aspects, and he hoped in its best relations. Lastly, he might be permitted to make but this one more observation, which had an indirect if not a direct bearing on the whole question of training colleges and their management. He had quite recently seen observations in some of the papers to the effect that they did not see the connection between education and health; but he could only say, having done such little as from time to time he had been able to do for the promotion of the national health, that he had always held that the basis of that was—he would not say exclusively, but in large measure—to be sought not in the material surroundings of the people, but in the nature of their personal characters, and in their moral fitness to improve their own surroundings. And, therefore, the advance of education, and with it of the whole powers of the country, mental and bodily, ought to rest upon the soundest basis of reason and wisdom in respect of both.

The CHAIRMAN (Colonel Donnelly) said some portion of this paper contained a criticism on the Report of the Commis-

sioners on Technical Education, with which he did not propose to deal, and another contained a criticism on the examiners of the Department, and with regard to that point, perhaps their reports had been a little misunderstood. The examiners had the papers from the whole country before them, but they did not know the name of the writer of a single paper, nor where it came from. That system had its advantages, in fact, it was essential to any proper system of examination that the examiners should know nothing about the writers of the papers; but it had its disadvantages, because the examiners necessarily treated them as a whole, and gave one opinion on the whole mass, without distinguishing one school from another. Thus they would say that the teaching was bad if the percentages of failure on the whole were large. But the percentage of failure in some schools might at the same time be very small. It would no doubt be pleasanter for the people who taught well if they were not included with the rest; but dealing, as the examiners had to do, with the papers, they could only make a general statement. It was no answer to their report to say that in such and such training college science teaching had been good; there was no doubt it was exceedingly well done in some training colleges, and he believed all the examiners would admit that they were, in fact, astonished that it should be as good as it was. They were told that the science teaching was in addition to fourteen subjects in the first year, and fifteen in the next year; and how the students, when they came to be examined, disentangled one portion of the materials from the other he did not know, but he thought it showed great skill on the part of the teachers. He did not know if any one had any suggestion to offer for getting out of this difficulty. The problem really was how to get ninety to one hundred minutes into an hour; that was what it came to, for unless they could make up their minds to throw overboard some of the subjects he did not see what was to be done. On the other hand, no doubt, in training a teacher for an elementary school you had to consider that he had

to teach a great deal more than science, and he had to learn a great deal when he arrived at the training college, for many of them had really very little information to begin their college course with. One remark of Mr. McCarthy's he could not agree with, viz., the expense of teaching science in training colleges, for he believed that where the teaching was fairly done the grants from the Science and Art Department were generally considered pretty liberal. He concluded by proposing a vote of thanks to Mr. Reatchlous.

Mr. REATCHLOUS said he was quite aware that some parts of the paper were not exactly in agreement with the opinions of some gentlemen present, but on the whole he was not dissatisfied with the remarks which had been made.

The CHAIRMAN said there was one remark he had omitted to make in reply to a suggestion of Mr. Evans, that the Science Training College at South Kensington should be used for training teachers from training colleges. Something might be done in that way some day, but there was this to be borne in mind, that those teachers wished, as soon as they could, to get away from the training colleges to get employment and begin to earn their living.

The following paper, by Miss Fanny Calder, was then read by the Rev. Canon Warburton :—

PRACTICAL COOKING IN ELEMENTARY SCHOOLS.

By Miss FANNY L. CALDER,

Honorary Secretary, Northern Union of Schools of Cookery; and Hon. Sec., Liverpool Training School of Cookery.

AT a moment like the present, when the cry of over-pressure in the schools is almost strong enough to arrest the progress of the great education wheel, a paper that ventures to lay a comparatively new subject before the public, and to press

upon school managers its adoption in the Elementary Schools, may perhaps need to spend a few minutes in self-defence.

The subject to be dealt with, viz., Practical Cookery in the Elementary Schools, cannot for one moment be called technical instruction, as it forms [or ought to form] a part of the daily occupation of the greater number of the women in the land, affecting their home-life even more than the "three R's and sewing," next after which Mr. Mundella places it in importance in the Code.

It seemed no mere coincidence, but rather a proof of the convictions of the day, that while H.R.H. the Prince of Wales was heading a Royal Commission to inquire into the condition of the houses of the poor, his brother, the late lamented Duke of Albany, in his last public speech, was advocating most earnestly and sympathisingly the adoption in our schools of Practical Cookery, as a subject well calculated to fit the growing generation to appreciate, and even enjoy, the house improvement which that Commission will doubtless shortly bring about. On that last memorable visit to Liverpool to present the Scholarships of the Council of Education, H.R.H. also distributed to Elementary School girls the Cookery Certificates of the Liverpool Training School of Cookery; with these words to the Council: "I come now to another point in your programme on which I am anxious to say a few words—I mean the help and encouragement which you offer to the teaching of cookery in elementary schools. . . . What I desire is to see cookery taught in the most ragged schools . . . . this cookery of course should be of the simplest, plainest kind; but it should be such as to show that with the coarsest material and cheapest apparatus, a neat, clean and thrifty manager may set before a hungry man a meal which he may eat with pleasure, and with no need to resort to the public-house to wash down an unpalatable and indigestible mess. . . . I should like to see meals which are now mere scrambles becoming points of real family union, occasions for showing forethought, kindliness, and self-respect . . . . and I think

that if we can train the children early to see the difference between what dirt, and waste, and selfishness make of a poor man's dinner, and what thrift and care and cleanliness can make of it at the same cost, we shall be civilising them almost more directly than by our sums or our grammar, and shall be taking in flank our great enemy drink—drink, the only terrible enemy whom England has to fear." There is a standard for the home-life.

Now as regards the children themselves, Mr. Mundella's reply to the cry of over-pressure was, that the children are not *over* taught but *under* fed. This speaks for itself. All who know the people at all, know well that in thousands of cases it is *not* poverty that starves the family, but the housewife's ignorance of thrift, of sanitary laws, and of the art of providing, or of preparing, proper wholesome food. Instead of philanthropy helping to pauperize by *giving* food to poorly-fed children [or worse still, the State undertaking to do so], let efforts be directed to introducing into our schools a subject of instruction so valuable and important to girls, whatever their after-calling in life may be. And to judge by what has already been accomplished, we may confidently expect to find a very perceptible improvement in the physical condition of our school children. To this end a great deal has been done by the Department. Schools of Cookery have through years of experience worked out the problem of the introduction of Practical Cookery into the Elementary Schools; and our present purpose is to point out the simplest and most economical methods of doing so. For step by step the Committee of the Liverpool School of Cookery found out the hindrances and the difficulties in the way of the accomplishment of this object, and for several years have given their best attention to the elaboration of plans that might meet these difficulties—difficulties as to time, room, utensils, expenses, disposal of food cooked, Government grant, and distance from a centre.

It is probably known to all here, that up to 1883 cookery was taught under the head of Domestic Economy,

but by theory, and from books only. The results were eminently unsatisfactory to all concerned. In consequence of various petitions and deputations to the Education Department, the Code of March, 1882, contained the promise of a grant of 4*s*. a year for every girl over twelve years of age who had attended a Practical Cookery class for forty hours in the year. This is quite distinct from the grant for Domestic Economy, which can be gained by *theoretical* instruction only, and makes it quite clear that mainly *practical* work is expected as the qualification for the new grant.

A year's experience showed that a fixed age prevented many of the most needy from benefiting by such lessons, as in the poorer schools most children leave as soon as they have passed the IVth. Standard—generally at eleven, sometimes even at *ten*, years of age.

[The IVth. is the Standard most are compelled to pass before they can leave school.]

This difficulty was laid before the Vice-President and the Secretary of the Department, who gave to the appeal the kind consideration and attention which they have always shown to this useful subject, and the difficulty was promptly removed, the Code of March, 1884, allowing *any* girl in the IVth. Standard and upwards to claim the grant. As soon as this was known, numbers of schools throughout the country applied for information, how to set to work.

Of course, a new branch that requires special preparation presents many difficulties to managers and teachers totally unacquainted with its working, and we wish here to point out ways and means of obtaining instruction at the smallest cost that is compatible with thorough and efficient teaching.

The plans we are about to discuss are such as were laid before the Department by the deputation of ladies and gentlemen from the Liverpool School of Cookery, who waited upon the Lords of the Privy Council on Education in December, 1881. Teaching power and plans of in-

struction, utensils and fittings, time for the forty hours, and the disposal of the food cooked, are all points anxiously inquired into, and each will be dealt with in turn.

Efficient teaching is, of course, the first point, and managers and head-teachers all see the perfect impossibility (as a rule) of adding it to the duties of the schoolmistresses, whose time and strength are already fully taxed, and who by no means desire to take up this additional burden. The teaching of cookery is not simply the preparation of certain dishes, which might be shown by any ordinary cook, but includes much instruction on the nature and use of food, and in the difficult art of choosing suitable nourishing and at the same time economical articles of food, in order that the smallest incomes may stretch to meet the needs of even the largest families. Such instruction as will give the children an intelligent interest in the matter, so that, understanding clearly the true purpose of eating and what things serve that purpose best, they may eventually become thoughtful, thrifty housewives or servants, not merely mechanical workers or unintelligent drudges.

Of the training of teachers for this subject, a most important part of our scheme, we hope to speak at another opportunity, but teachers are specially trained for the work in elementary schools at some of our large Training Schools of Cookery, and diplomas of efficiency are awarded there.

A teacher can give two lessons a day, *i.e.*, ten in a week throughout the school-year, and take several classes in one school or single classes in several neighbouring schools for the time required to make up the Government number of forty hours. Circuits are sometimes arranged for a six months' course, the teacher going from place to place every week, so that several towns can combine to share the expense of her services. The usual plan is to give one lesson a week of two hours' duration, so that the course is accomplished in twenty weeks, *i.e.*, a school half-year. The teacher's salary for the year or half-year is then divided between the schools according to the number of classes

they have had. It is very important these classes should not be large, or the girls will not obtain sufficient practical experience to justify the term of "*PRACTICAL* Cookery," and precious school-time may be expended with unsatisfactory results. In the printed plans which are here for inspection, it is recommended that a class should not consist of more than twelve, or at most fifteen, girls, that number being quite as many as even a good teacher ought to have under her supervision while they are themselves cooking; that, with the cleaning and putting away of the utensils used, being really the chief part of the lessons. [No assistant-maid is employed in these classes, as the girls are taught to clean everything and leave all in nice order.]

The twenty lessons comprise the elementary knowledge of the nature, use, and preparation of the various classes of food, as meat, vegetables, fish, soup, puddings, bread and invalid cookery, with practice in the best and most economical methods of cooking them. The lessons are alternately demonstration and practice, that the faculty of imitation, generally large in children, may be called into useful exercise. At one lesson the children are shown the way, nicely and neatly, to prepare and cook certain dishes, at the same time explanation is given of the nature and use of the food then being dealt with, and they are questioned as to cost, time, and quantities. A most important point to which I particularly wish to draw attention is that the recipes of all the dishes taught in these classes are printed in clear type, with the price of each ingredient and the cost of the whole dish. Every girl is supplied with a copy of each recipe, to which she refers during the teacher's explanation, and being thus saved the waste of time and thought in writing and spelling, is free to give her whole attention to the teacher's instructions and *manner of working*. At the next lesson the girls cook those same dishes, with their recipes to refer to, and under the direction of the teacher, who generally finds herself fully employed in overlooking the practice work of twelve or fifteen girls. They work together in sets of three, and

take it in turns to do the cleaning, which is almost as important as the cooking itself, cleanliness and neatness being essentials to good housekeeping.

But how are the forty hours to be found when the time-tables are already so crowded? Experiences differ, but the greater number of schools seem to take a portion of time from advanced arithmetic, grammar, or drawing, a plan fully in accordance with the opinion of the Department, that "after the three elementary subjects and sewing, *no subject is of such importance* (as cookery) *for the class of girls who attend public elementary schools*, and lessons in it, *if properly given*, will be found to be not only of practical use, but to have great effect in awakening the interest and intelligence of the children." And so in fact it has already been found, and the children wake up to the advantages of head knowledge by being thus called upon practically to apply it. During the lessons the children receive marks for work and attention, and at the end of the course go through a verbal and practical examination, for which certificates are awarded by the Liverpool School of Cookery. If through illness or other cause any girl should miss one or more lessons of the course, and so have failed to complete her forty hours, extra lessons can be given at special times on the omitted subjects. This whole plan has been found to work most satisfactorily.

The cost of the necessary amount of food cooked at these twenty lessons is something under £1 17s. for the whole course. This is easily recouped by the sale of the dishes, either to the teachers, to the children, to the parents, or for the sick poor of the neighbourhood. It is usually in great demand, and if in one or two cases the full amount has not been returned, there are others in which there is always a profit upon the sale. In the plans before the Conference the system is plainly set out, giving exact details for those who need them, while at the same time it is quite open to managers to change the dishes for others more suitable to their localities, or to the particular season of the year.

The all-important question of fittings and utensils is next before us, and we wish it to be clearly understood that all these experiences have been in the direction of simplicity and economy, in order to make it possible for the subject to be taken up by the very poorest schools, where naturally [if there are degrees in such a question] such instruction is most needed. Also we wish it remembered that these expenses once incurred do not come again for some years, therefore school managers need not take fright at the sound of £5, or £10, for the first outlay. Our papers show that the cost of all the utensils necessary for a practical class of fifteen girls, including crockery, linen, and materials for cleaning, amounts to £5 7*s.* 10*d.* supposing they are bought by retail. These can all be stowed away in a single hamper and kept in a corner of the room, if there is no cupboard to keep them in, or no money to make one. Under the same circumstances the tables can be improvised of boards laid across the backs of desks, and answer the purpose very well, besides being easily stowed away if the class-room is very small. A very moderate-sized class-room will quite suffice for the purpose, and if in smaller schools even this should fail, the kitchen of a neighbouring house or cottage can be employed instead. Although it is very satisfactory to have special and well-fitted rooms, they are by no means essential to the success of the subject or the thoroughness of the teaching. The scullery work can be accomplished by the use of ordinary washing-bowls, but of course it is neater and more comfortable to have some scullery arrangement. If the class-room is conveniently placed for it, a sanitary sink can be quite easily fitted in, with a pipe opening into a drain, and if water is near, a tap to let it into the basin. In these times when every device is employed to simplify our health appliances there is little difficulty in making these arrangements; and such a sink can be had for about 15*s.* from A. Kenrick and Sons, West Bromwich.

The stove is a matter that greatly depends upon existing local circumstances. If there is, as we often find, a small

kitchen range in the class-room, an extra gas table-stove holding two or three pans will suffice for the class. If there is only a simple fireplace, a stove with an oven is essential, and can be supplied either by a small gas oven, or by a small fuel stove with an oven, in addition to the fireplace. If there is no fireplace at all, a small range with a boiler for about £3 10*s*., the fixing in of which will cost another £1, is very suitable for the purpose—to be had at Bennett Bros., Liverpool. Should a moveable stove be more desirable, there is a nice suitable gas stove made by Fletcher of Warrington, the "Eureka" stove, by Wright of Birmingham, or a neat little fuel stove, "The Mistress," for £4 10*s*. or thereabouts, by Smith and Wellstood. A newer one, "The Little World," has various additions, but it costs more. Either of these latter need only a pipe leading up a chimney, or out of a window-pane or a hole in the wall, and can be removed at any time. The old objection to teaching with gas has quite passed out of sight; no girl has ever found any difficulty in working with the simple utensils she has at home, because she has learnt on a gas stove. If the principles are thoroughly explained, an average amount of common sense will carry them out under any variety of circumstances, and this practical teaching does a great deal in helping to develop common sense.

Either of these stoves can be boarded over at such time as the cooking is not going on, and serve as a stand or table, instead of being an inconvenience in a class-room. Thoroughly good work has been done under these very simple conditions, so that Her Majesty's Inspectors can be quite satisfied that the requirements of the Code, viz., "special, adequate and suitable arrangements for the practical instruction of the girls by a duly qualified teacher in a room (which may be an ordinary class-room) fitted up with the necessary appliances," are properly fulfilled. There can be few places in England where some well-wisher of the people cannot be found, philanthropic enough to help with this first outlay, which is the hindrance in

poorer schools. Or we may hope that possibly one or other of the organisations which are formed to promote education, as the National Society, or the Science and Art Department, may see their way to making grants for the purchase of these utensils. The Liverpool Council of Education has been doing so for more than two years, but of course in Liverpool only.

To meet the fear of "another subject to add to the pressure," we need only point out that *practical* work is a relief to the brain, calling into healthy action the stores of intellectual knowledge laid up there. Anyone who sees a class of girls at work over their cookery, with bright countenances and eager manner, evidently enjoying the weighing and the measuring, and the counting-up of the cost, will feel assured that we are on the right lines of education; that this is no mental strain, but a wise and productive application of the mental acquirements of the past years of school life.

We could multiply instances and anecdotes, that would tell how the girls like these classes; of the use cookery has been to them in daily home-life, and in the sick room; of the taste it has excited for domestic service—a cook's work being found so *very* interesting; of the intelligence it has awakened in the often more dormant minds of Industrial and Workhouse girls, and even of the excellent work done and examinations passed, by barefooted girls *and boys* in the night ragged schools for our gutter children.

These, and the thanks of grateful parents, who in some schools willingly pay an extra fee for their children to have the benefit of the cookery lessons, clearly show to school managers and teachers, that in taking up this subject they are attaining the point desired by the late Duke of Albany, that, "in planning for the poor, we should show that we are anxious to help them to things obviously agreeable to them, as well as to disagreeable things which we know to be good for them."

Now one word more. It is very important that the value

of special training for cookery teachers should be brought before this Conference, as there is no point connected with the subject on which there is so much vagueness in people's minds.

The nature of the cooking instruction is so little understood, that it is generally imagined that a sensible, good cook, or a philanthropic lady, with a taste for housekeeping, will quite accomplish all that is needed, totally forgetting the vast difference that lies between *doing* work one's self and *teaching* others to do it.

In reality, special training, general culture, personal handiness and practice in the art of teaching are very important, we might almost say, absolutely essential, to make the cookery lessons efficient. The teaching of cookery, far from being a merely manual work, makes great demands on the general culture of the teacher. It includes much instruction in the use, nature and properties of the different kinds of food, and the difficult art of choosing both nourishing and economical dishes, so that as much comfort as possible may be got out of the smallest incomes. Sick-room cookery, especially, is a branch most important to teach, being almost unknown amongst the people ; and to teach it well requires, on the part of the teacher, a clear acquaintance with the elements of physiology, of hygiene, and even of chemistry.

The grant is made by the Education Department on the condition that the lessons are *properly given*, which we take to mean, given by teachers who are qualified to do their work thoroughly. It is not sufficient to teach girls how to do things, but they should know the reason of all they do, and have such an intelligent understanding of the needs of the body, and the means of supplying these needs, as will enable them to avail themselves of every resource within their reach ; and, if one accustomed article of food fails, to have the wit to turn to some other grain or vegetable equally nourishing, though different. We are frequently told that there is a vast amount of good, wholesome food wasted by our people, and many new things

rejected from sheer ignorance of their nature, and how to make use of them.

All this instruction means a fairly broad education on the part of the teacher, with complete mastery of the practice of cookery, and the power of imparting this knowledge in a lively, attractive, and efficient manner. Experience shows that the more highly the student has been educated, the more general information she brings to her studies, so much the better cookery teacher she becomes.

The occupation is one which highly commends itself to well-educated persons, from whose ranks it is most desirable the staff of teachers should be drawn.

It is also a work which requires a teacher's full strength and energy, and which, therefore, it is most undesirable to add to the present duties of our schoolmistresses, whose time and strength are already fully taxed. In the early days of this movement, when a large gathering of schoolmistresses was consulted on the advantage of introducing cookery into their schools, they all agreed that it was a most desirable subject to take up, but equally unanimously begged that no plans should be suggested which would require them to add cookery to their other duties. Of course there may be exceptional cases of schoolmistresses who would pass in cookery, and find time to give the lessons themselves.

But we advise very strongly that if the subject is to be taught efficiently, and to the satisfaction of Her Majesty's inspectors, the lessons should be given by special teachers, regularly trained in those schools of cookery where diplomas are awarded, and with particular regard to proficiency in teaching children of the working class. In this way only can managers feel assured that their children are taught to become thrifty providers as well as good cooks.

To secure a supply of such duly qualified teachers, the Northern Union of Schools of Cookery was formed in 1876. When it was ascertained that there was no probability of one good general standard of marks and require-

ments for diplomas being arranged for the whole country, several leading schools of cookery agreed to unite in a scheme for adopting a uniform method of training teachers, and to offer diplomas on such a thoroughly efficient basis that the public might always feel secure of good work when engaging a teacher holding one of them. As far as possible the same plans are followed in all the training schools of the Northern Union, due allowance being made for varying requirements of different localities, and the diplomas given after the training in the different schools are recognised as of equal value throughout the country.

There are two kinds of diplomas conferred by the Northern Union, one for *Teachers of Artisan Cookery* only, and one for *Teachers of all branches of Cookery;* and in each of these departments there are first-class and second-class diplomas. The fee for the course of training for the former is £7 7*s*., for the latter £10 10*s*. The standard for these diplomas has been purposely kept high, and it has proved not too high for the teaching provided in the schools of cookery, and whenever the system of the Northern Union has been carried out, it has been found most satisfactory.

The training for a diploma of the Northern Union occupies from five to six months. After taking the different courses of lessons required for her own instruction, and having passed two theoretical examinations, the remainder of the student's time is employed in practising the art of teaching cookery, very special attention being given to qualify her to teach children in the elementary schools. If her specimen lessons satisfy the requirements of the committee, marks for efficiency in teaching are added to those already obtained for practice and theory, and all go to make up the diploma. Considerable time is given to the study of various standard books on science, food, and household management.

If cookery is to be taught in our elementary schools as efficiently as all the other subjects authorised by the Education Department, it should be by teachers trained

for the work, and holding some diploma which will assure the public that they are properly fitted to undertake these classes. Some such diploma is the only test by which managers can judge whether a candidate for the post of Teacher of Cookery is at all equal to the work.

DISCUSSION.

Miss ROBINSON said, from considerable experience in connection with a Yorkshire district association for teaching cookery, she could endorse what had been said, and would explain the course they had pursued. The question, in the first place, was the kind of teaching, and from some considerable experience she was satisfied that no kind of elementary school teaching was of any value except practical teaching. Demonstration teaching awakened their interest, and made them anxious for further knowledge, but theoretical teaching alone was useless and failed to convey a really useful knowledge of the subject. Having decided that the teaching should be practical, Miss Calder had explained how simply and easily it could be given. In towns where a School Board existed, there would not be much difficulty if they chose to take it up, but she had had to work with voluntary schools very badly supported, and always in a state of debt, and there the difficulties were very great. She had to beg the money for the materials and vessels for two centres. The inspector, whom she consulted, considered that two centres would be sufficient, and she, therefore, obtained a loan of one room in which was a very suitable fire-place, &c., and there she had merely to get a small quantity of appliances. In the other case she took a set of rooms in a workman's dwelling, thinking that those were exactly the homes to which the children were accustomed. They were two fair-sized rooms, fitted with a common fireplace and oven, and water was laid on to every floor, but it had to be

brought in, for she did not go to any further expense about it. There twenty lessons were given, and for part of the time it was found to be really better to bring them all to one centre, as it lessened the labour. For these lessons the children paid one penny each, and those pence enabled her to pay every expense except the teacher's salary; the food that was cooked was sold, and she had a balance at the end of £3 10*s.* to the good. The children were practically taught to clean; they were worked in sets of four, and every one did something each lesson. They washed up, scrubbed the tables, and washed all the vessels, but did not scrub the floors, although they wished to do so. Attention was paid to the tasteful serving up of the food, and laying of the table, and they did not even grudge a little bit of parsley to make the dish look nice, because she wished them to be able to serve up a dish in their own homes, which should be not only palatable, but nice looking. That went on for twenty weeks, and perhaps the experiment might be repeated; the only difficulty would be to provide for the teacher's salary by a voluntary effort. Anyone anxious to take up this work might feel pretty sure that the children's pence would provide all other expenses. It was most essential to employ trained teachers; as for expecting any school-mistress to take it up, it would be hopeless, though it was most important to elicit their sympathy. It would be no waste of time to give a course of lessons in the evening to school-mistresses who liked to attend. She could tell in a moment, from the girls, whether the mistress was interested in the matter or not; and in some mixed schools, where there was a master, she found the girls would be absent half the time, and would not care about it. But where the mistress took an interest, the children always appeared interested, and said the mistress asked what they did, and liked to hear what they were doing. At the end of the course two or three of the mistresses wrote letters of thanks, and several came and expressed their thanks personally, and so did several of the parents; and one poor woman brought a friend with her, who took

a twopenny book of receipts, and insisted on paying a shilling for it, in order to help on the good work.

Miss MAITLAND said the position she held in Liverpool was that of examiner of children in voluntary schools who took cooking lessons. It had been decided in Liverpool that the instruction given to the children should be strictly educational. In attending the various meetings there, she had been very much struck with the continual use of the word educational, and with the fact that in many minds education was confounded with knowledge, forgetting that all the knowledge given to children was useless, unless with it they also had education, which was the drawing out and training of their powers. It was no use pouring into them a continual series of facts, and stuffing their minds with knowledge, without drawing out the powers of their minds. They had, therefore, made a great effort in Liverpool that all their cookery teaching should be educational, and, in saying this, she might speak also for the Yorkshire school of which Miss Robinson had spoken. Another point they were anxious about was that the children should be taught something about diet and dietaries. Everyone who worked amongst the poor would agree that it was not only their ignorance of cooking, but their ignorance of the simplest laws of diet which caused so much suffering amongst them. There were many mothers in working men's families who, in times of difficulty and distress—hard times as they called them,—endeavoured to meet all the trials of their life upon a diet of white bread—it would be better if it were brown—and tea, when, of course, as everyone there knew, there were many other more nutritious diets which would be no more costly. It was only ignorance which kept this going; and it must lead to a deterioration of the race if the mothers of working men's families lived on such diet. One word as to the teacher. In many people's minds there was an idea that any cook could teach cooking, and perhaps she could in a way; but she would ask the mistresses of middle-class houses, who knew what went on in the kitchens,

whether that sort of thing was what they wanted to have perpetuated. The careless and needless waste, and rule of thumb operations which went on, were not what they wished to have taught in schools. She felt this was a subject to be approached with great diffidence in a mixed assembly, because every man born considered himself a good judge of three things—of a horse, of wine and of cooking,—and no doubt that might be true ; but with regard to cooking, she thought he was a judge rather of the results than the methods, and it was not possible for an inspector of schools—for after all Her Majesty's inspectors were but men—to be expected to understand all the details required in giving a lesson on cooking.

Mrs. ROWLAND WILLIAMS, of Liverpool, said that Miss Fanny Calder in her paper had spoken of the necessity of having efficient teachers of cookery, in order that the scheme advocated might be properly carried out. This was a most important point, and one which could not be too strongly insisted upon. Failure in this respect would be most disadvantageous to the advance of the subject and would tend more than anything else to throw discredit upon it.

The Education Department's grant for cookery was conditional on "special and adequate provision" being made for the teaching of practical cookery, and no provision could be considered adequate which did not include the competent teacher. By the *competent* teacher was meant a teacher who had been properly qualified for the practical work by having been trained in the most approved methods, and who had, at the same time, studied the elements of the different sciences which have a bearing upon cookery, so that she not only showed her pupils how to do the manual work, but was also able to explain to them simply and in an interesting manner the reasons for what they were taught to do. All this implied a good deal of education, and was quite beyond the sphere of the ordinary cook. They wanted women of education, and possessing general culture, to undertake the work. And it was a work which might very well commend itself to the attention of such .

The questions of how cookery teachers were to be obtained, and how their competency was to be guaranteed, were so important, that she desired to bring before the notice of the Conference the association of schools known by the name of "The Northern Union of Schools of Cookery"—an association which had been set on foot for the express purpose of organising good systematic teaching throughout the schools which formed the association, with a system of examinations to ensure its efficiency, and which formed a centre from which certificates and diplomas were issued to teachers so trained upon an acknowledged standard. No such centre had previously existed for the conferring, according to a uniform method, diplomas on teachers trained in local schools, and it was the felt need of this which gave rise to the association.

The Northern Union of Schools of Cookery, of which she had the honour of being President, held its first council meeting in Liverpool in 1876, and Liverpool continued to be the head-quarters of the association. The secretaries of and other delegates from the different schools formed the council, by whom the examiner was appointed, and other business transacted. Examination papers were forwarded to the local schools as required, and the examinations were arranged by the local committees, by whom the papers were forwarded to the examiners. A uniform system of marks was adopted in the different practice kitchens, and the marks gained were added to those given for the theoretical examinations.

The course of training for a full diploma occupied from five to six months. There were two diplomas, the artisan diploma for teachers of artisan cookery, the fee for training for which was 7 guineas; and the diplomas for teachers of all branches of cookery, the training fee for which was 10 guineas. The training occupied from five to six months. The student was expected to study the elements of physiology, and to acquire at least such a knowledge of the structure of the human body and its functions as would enable her to teach her pupils what was needful for the building up and keeping it in health.

She was also required to gain some knowledge of the chemistry of food, and of different food values as articles of nutrition, so that she might teach how, though incomes may be small, nourishing diets of great variety might be selected, and especial care be given to cookery for the sick. Some knowledge of the laws of heat in their effect upon different substances was required. Certain books were to be studied and attendance at lectures, and as much general culture as possible was recommended. The books recommended were: —'Food,' by A. H. Church, M.A.; 'Physiology,' by D. M. Foster; 'Domestic Economy,' by C. T. Bartley; 'Food and Home Cooking,' and 'Health in the Household,' by Mrs. Buckton; and 'Scholars' Handbook of Household Management and Cookery,' by Tegetmeier. The latter half of the time occupied in training was directed chiefly to acquiring the art of teaching, and especially the art of teaching children in the elementary schools. The students were required to give a course of practice lessons, and had also to give demonstration lessons in the presence of competent judges. Two theoretical examinations had to be passed, and there was a fixed standard of marks which must be gained for these, and also for work done in the practice kitchen, and for proficiency in giving lessons. The standard had purposely been fixed high, but not higher than the teaching given in the training schools warranted. And it would be possible to point to a number of teachers thus trained, and now holding diplomas, who would serve to prove the efficiency of the system.

She would like to add a word as to special teachers for this department. At one time there was the idea that the ordinary schoolmistress might add the teaching of cookery to her other work. But at the Domestic Economy Congress held at Birmingham, August 1877, and at a later one in Manchester, 1878, they strongly urged that this would be a great mistake. And at a meeting of school teachers held in Liverpool a very strong feeling was expressed to the effect that it was quite impossible they

could undertake this; and anxious as many of them declared themselves to be, that practical cooking should be taught in their schools, they most earnestly deprecated it if it was intended that they were to undertake to teach it. It would be fatal to its introduction into the schools if it were added to the teacher's work, for teaching cookery as it should be taught necessarily involved much physical and mental strain. The lesson should be given in an animated sympathetic manner, so as to gain and keep up the attention of the class, and by constant questioning the teacher should test how far the children were taking in the information she was giving. Now all this required a teacher fresh for her work, not one already overweighted with the lessons she had to give. Feeling the importance of this, at one of their councils, the Northern Union passed a resolution to the effect "that the committee strongly recommended that the managers of elementary schools should be advised not to add to the work of their general teachers, but to employ, as teachers of cookery, teachers trained entirely for that department, and further—that no teacher of cookery should be permanently employed who does not hold a diploma." And though here and there it was possible an exception might be made in the case of small country schools, and the mistress might be trained for the diploma, further experience would lead them to urge still more strongly two points,—there should be special teachers, and no teacher should be accepted who did not hold a diploma issued from a well-organized centre.

Mr. W. STEPHEN MITCHELL said he was very glad to hear that the subject of practical cookery was more and more coming to include that of practical dietary as well, and he should like to elicit, if possible, some information as to the extent to which the practical teaching of dietary was carried on in schools where cooking was taught. Some seven years ago, it would have been considered a totally different subject, but gradually the two things were coming to be more and more coupled together, and ladies, who might be

supposed to know as little about test tubes and laboratory work as men were supposed to know of practical cookery, were beginning to see that the two things must go hand in hand together. Six years ago he read a paper at the Society of Arts on this subject, when he put the question as to what was being done in the way of teaching by means of the food collection of the Science and Art Department, but he then failed to get any information whatever. But now he believed if the matter were earnestly taken up the difficulty of getting teachers would not stand in the way. This was a subject which must be taught practically instead of through books. As books had been mentioned, however, he would refer to Professor Michael Foster's 'Physiology,' a portion of Balfour Stewart's 'Heat,' and a portion of Roscoe's 'Chemistry,' all published by Macmillan, which might well be used together with practical teaching. He hoped to hear from some ladies present to what extent practical chemical demonstration was conjoined with the teaching of cooking, so as to enable the children to understand how the diet tables of the Science and Art Department had been arrived at, and how they were to be applied to their every daywants. If this were done, there would be no such mistakes made as had been alluded to with regard to the use of bread and tea. Dr. Buchanan's report on the health of the operatives at the time of the cotton famine showed how people died, practically in consequence of attempting to live on such a diet.

Professor GARNETT said one of the conspicuous features of the Conference was that so much stress had been laid on the importance of accurate measurements, and there was no subject in which its importance should be more properly brought forward than that with which they were now dealing. There were many plain cooks who could seldom produce the same thing twice over with the same result, simply on account of the carelessness with which their measurements were made. You constantly saw directions in cookery books to take a cupful of this, and a tea-cupful of that, and a small piece of something else, and

it was very important in teaching girls cookery that their attention should be called to the necessity of making accurate measurements of everything they handled. Surely there were recognised units of measurements which were adopted by engineers and commercial people which would be applicable to the kitchen too.

Miss ROBINSON said this point was very carefully attended to in all their lessons. No cookery could be satisfactory without exact measurements or weight. She always said, in giving a lecture herself, there was no royal road to cooking; they must take scales and measurements and go exactly to work, and be precise as to time also, or satisfactory results would never be obtained. But as for teaching children chemical science in twenty lessons, it was utterly impossible. Teachers were taught the science of dietary, and endeavoured to teach the children as much as they could comprehend, and those young girls, who came without any preparation in science, could only have a small amount of instruction given them. They were, however, taught what food was most nutritious, and what went to produce blood, and bone, &c., and the examinations at the end of the course showed that they understood it, and if questions were put on any former lesson, they could tell why and wherefore every ingredient was used.

Sir THOMAS ACLAND, Bart., M.P., said although he was only a man, and was therefore obliged to judge by that which was the bane of all teachers nowadays, results, he did wish to say a word or two on this matter. In the first place he hoped the ladies would forgive him if he said they had none of them yet mentioned what he believed to be the best book on the subject, viz., one written by Miss Guthrie Wright, of Edinburgh, with the assistance of a physician and two chemists, the School Book of Cookery, published at one shilling, by Macmillan. Another valuable book was published by Allman, of London, for one penny, written by Miss Barnett, niece of Mr. Le Neve Forster, and officially connected with the School of Cookery. He had heard that lady teach in three places, and, without

any disrespect to men, he thought he had never heard any man teacher teach better than she did, if as well. She was put to rather a severe test too, because on the first morning she was taken out to her class she was told she was not to start with her South Kensington ways, but to go into a cottage where there was no stove, only a wood fire, and no saucepans, and there she was to cook a dinner. However, she showed a great deal of good temper, and paid those she came to teach the compliment at the end by saying that although she came to teach she must confess she had learnt a good deal. He had seen something of the cooking classes at South Kensington, and of what had been done by Mr. Leveson Gower, who, he believed, was a very good judge, and he felt very grateful for their efforts, but they wanted to bring the teaching of cookery close home to the cottages. In the country they had not the opportunity of going to shops and getting the snippings of the fowls, the trimmings of fish, and so on; they had potatoes, pigs, and their gardens, and once or twice a week, perhaps, they had a bit of meat. The labourers wanted to be taught not to waste that meat, not to burn it in the frying-pan, and it was extremely difficult to introduce systematic teaching of this cookery into country places in schools. The poor children in the country had great difficulties in the food question all the way through, and what they had to do was to teach them very simply how to make the best of small materials. He had seen this result come from the teaching of Miss Barnett, and the study of Miss Guthrie Wright's book, in a west country village, where oatmeal was never heard of, but where rice had been used for many years, being sold at cost price to the poor; it had led to this result—that the farmers' wives, and other persons in the middle ranks, were so thoroughly made alive to the difference between starch food and albuminous food that it was resolved at once to use Scotch oatmeal and split peas as well as rice, and in that village now, for the last three years, that oatmeal was largely used by sixty labourers' wives. That was a practical proof of what might be done by bringing the teaching home to

the poor in the country. It was very difficult to meet the various requirements of a capitation grant by a systematic course in village schools, because you must have a person who thoroughly understood the subject both in principle and in practice, and that must be paid for; and as to grouping schools, in the country it was a very difficult matter to carry out. But a good and intelligent teacher who understood the principle and practice going down and instructing the farmers' wives, who had to train the girls who were going out to be servants, might do an immense deal of good.

Miss ROBINSON said in mentioning the books for training teachers, she had simply spoken of those used in their own schools. They did recommend 'Rudiments of Cookery, with some account of Food and its Uses,' a little manual by "A. C. M."

Sir THOMAS ACLAND said that in the book he had mentioned almost every book which had been named was included in a list recommended.

Mrs. WEBSTER said she had known a good deal of the teaching of cooking in the London Board Schools, having been a member of the Cookery Committee for some time, but there was one fault in the programme which she believed existed all over England, and it had not been alluded to, either in the paper or by any of the speakers, though Sir Thomas Acland had pointed out a kindred one. In what they were doing in teaching English girls to cook, the fault seemed to be in considering that English cookery was what it ought to be amongst the poor. They were accepting the miserable dishes and miserable style of cooking which had been hindering England for a long time, and were not making any attempt to introduce into English homes, not expensive cooking, but those common dishes which any one who had been much abroad and seen much of the working French women or Italian women, or the women of any country almost, except, perhaps, the Spanish, were familiar with. They made a good eatable dish out of materials which an Englishwoman would think of no use, and not only that, but would cook you, in some little dirty hovel

where you did not think there could be any fit materials, a dinner which people, possibly having some knowledge of cooking and a refined taste, could eat, whereas they could not, in England, eat a meal given to them by the wife of a working man enjoying a comfortable income as good as that of any curate. She did not blame the Cookery Committee of the London School Board—she had been a member of it, and shared the responsibility if there had been any shortcoming—but there was some room for improvement, not merely in regard to cooking, but also in regard to dietary.

Mr. BARROW RULE said they had only heard of women cooks, though he had always understood that men made the best cooks, but perhaps times were changing. He hoped gas stoves would not be used in any class rooms in the schools in this country, for they were very poor substitutes for open stoves, and certainly sent out a by no means pleasant or wholesome smell. The programme referred to the teaching of cookery in schools, but the general tenour of the discussion had referred simply to elementary schools, in which he certainly hoped that artisan cookery exclusively would be taught. Some few years ago in the district in which he lived they had had some experience of first rate cooking, they paid a handsome salary for a teacher of cookery, and she really did teach cookery, and all the pupil teachers were instructed how to make ices and all manner of very nice things, but it was found that they had not been taught in such a manner as to make them at all useful. If cookery were to be taught in elementary schools, it must be artisan cookery, for two reasons: in the first place men would marry, or they ought to, and as the girls must be prepared to make good wives and mothers, they must be taught to practise cookery such as their husbands would be able to afford; they must not run to them for this, that, and the other thing out of their wages, because Miss So-and-so had taught them that those were the things to use. They must be taught to make good housewives in the position

in which God had placed them, to avail themselves of the means their husbands could place at their disposal. There is danger of cookery becoming a hobby ridden to death, and perhaps ultimately excluded from the Code. With regard to teaching cookery in Board Schools, it would be no expense at all if they would only allow those teachers to give instruction who had obtained certificates. If the apparatus were found, the mistress herself would get all the materials, make them up, and then sell them to the children, keeping an account which could be produced when required. He hoped those who were at work in this matter would not attempt to run too fast at first and overset the coach.

Miss DAVENPORT HILL said she had much to do with the teaching of cookery under the London School Board, and should not like it to be supposed that they were altogether deficient in the knowledge of the properties of food, though they did not understand as she could wish; but she and her colleagues were always ready to learn, and try what they could do to improve the system. They were now beginning to train their own teachers in their cookery schools, which adjoined elementary schools, but stood by themselves in the playgrounds. The Board preferred taking pupil teachers, who, for some reason or other, did not wish to pursue their profession in an elementary school. They had learnt how to discipline children, which was very necessary; and after six months' instruction under a good instructor, and with attendance at a course of lessons in higher class cookery, they turned out very good teachers. No doubt, if the Board could impart some knowledge of chemistry, added to a little dietary, they would be glad to do so But she must dissent from what had been said about gas stoves. If the gentleman were to go into any one of the thirty centres belonging to the London School Board, he would not smell the gas; they had good stoves, and were very careful with them, and they were almost a necessity. If a teacher were demonstrating to a class sitting before her, she could not

turn her back to a range to do her cooking, she must be able to put the saucepan, or whatever she wanted, before her where the pupils could see it. Their rooms were airy and well ventilated, and these stoves gave no trouble whatever. Of course the Board did not think of teaching how to make ices. They confined themselves to common cookery simply. Mrs. Webster might be right, and they might improve their dishes, but they made them palatable; they taught how to warm up cold provisions, how to boil vegetables, how to cook meat in a tasty way, and they also insisted on cookery for the sick, which they considered most essential; how to make beef tea, mutton broth, gruel, porridge, &c., and how to make coffee. They were obliged to sell what they cooked; it was no use, therefore, to cook dishes which would not sell. The London School Board spent about £100 a month in mere food, an important item of expense. When they began, and for some years after, they lost money; but they were just now beginning to avoid loss, and they hoped by the end of this year the receipts would balance the outgoings. They were always striving to improve the mode of teaching as much as possible, and did not at all suppose they were yet perfect.

The CHAIRMAN (Colonel Donnelly), in summing up the discussion, said he had had on occasion to cook his own dinner, which brought the fact very strongly home to his mind that if he had not been very hungry he might not much have approved of it. At the same time he did not know that all men were to be considered to be ignorant of cookery, for they had heard of a *cordon bleu* among men; at any rate, if men were not so often cooks as women were, they all appreciated the result of the women's labour. It was really astonishing how little was done to put cookery on a rational footing in England, and very likely it came from the fact of our having such good meat, but the steps being now taken to teach cooking would no doubt, in time, bear good fruit. He remembered how a few years ago his old friend, Sir Henry Cole, advocated this subject, and how

he was laughed at for so doing, but the result of his labours was now being seen, and it ought not to be forgotten that he was the originator of the present movement for cookery schools. He was very glad to hear what Miss Maitland had said, that the teaching of cookery should be strictly educational, and he concluded by proposing a vote of thanks to Miss Calder for her admirable paper.

Miss FANNY CALDER said two or three things had been said which she did not like to leave unanswered. To begin with the remarks of Mr. Rule, if he would look at the lists of what was taught by the Liverpool School of Cookery, he would see that the whole twenty lessons cost £1 17*s.* 10*d.*, and he could not fear many ices or such high class dishes from that. As to gas stoves, they were extremely useful, and, in fact, cookery could not be introduced into some schools unless they were used. They never heard of any smell coming from them or any inconvenience. Sir Thomas Acland had spoken of the difficulty of getting school teaching into the country, but at the present time in the very heart of North Wales, at Festiniog, the course of lessons was going on. The mothers did not teach their children; they knew very little themselves, and never took any trouble to teach. She knew that in Wales, and other districts, where the children were taught cooking, they cooked the food at home, and the parents were very much pleased. These children mostly left school before they were twelve, and went out into the world, probably to become mothers, and they obtained much useful knowledge of how to make their homes clean, comfortable, and attractive, and how to make good use of the smallest amount of food which would come in their way. They did teach them how to use the simplest utensils, for, as she had said in the paper, they wished to make the smallest incomes stretch to meet the needs of the largest families, and therefore they must use very simple and cheap things. With regard to dietary, if any one would look at the plans and lists, and copies of receipts which were on the table, they would see the system adopted; every sort of food was

represented, and the children were taught how they could supply one kind of food by another in times of need. There was very great waste of good food in England, because the women did not know its nature and how to use it. The elder children were taught the nature of the food they cooked. She would also add that the gutter children of the night and ragged schools sometimes passed a better examination than the children in the elementary schools who were now receiving instruction.

TEACHING OF DRAWING AND COLOURING.

WEDNESDAY, AUGUST 6, 10 A.M.

Chairman: Mr. PHILIP MAGNUS.

THE TEACHING OF DRAWING AND COLOURING AS A PREPARATION FOR DESIGNING AND DECORATIVE WORK.

By J. SPARKES.

I AM associated in this subject with Mr. Ablett and Mr. Brophy, both gentlemen who have thought and worked in matters relating to the early and systematic training of the draughtsman, one in form and the other in colour. I may therefore assume that their interest in the subject will lead them to deal with the training of the designer in these sections.

A somewhat narrow limitation is imposed by the proposition. The designer is not made of drawing and colouring alone; he is, like the rest of us, a complex being, composed of bodily powers, which enable him to become a handicraftsman; a mind to direct his hand and eye, and a spirit to feel and sympathise with what is beautiful in form, colour and association.

I dare not assume, that in whatever school he was educated in his youth, he had a thoroughly sound training in freehand drawing, because I regret to say such thorough training is very rare in this country. If he were the son

of a mechanic, as it frequently happens he is, he would run a better chance of having a sounder training in this respect than if he were the son of middle class parents; and even in this class of life he would be better off than if he came from the higher middle class, for the teaching of practical technical drawing is good, in an inverse ratio to the social position of the school: the lower the better, the higher the worse. I venture to say, that with very few exceptions, the drawing taught in our large public schools is the worst in Europe. But let me assume that the future designer belongs to that section of society called the middle class, and that his general education is good, and that he has been taught drawing after a fashion. There is, I fear, small chance of his work having been systematic from the beginning. If it has, the boy has learned that every figure he has drawn, whether geometric or ornamental, is built, and thoroughly built on a geometrical plan; he has been taught to analyse and dissect his copy, until he finds by habit, and almost unconsciously at last, the main lines of its construction, its proportions, the masses which contain its details, and the shapes and exact contours of those details. If he has done this by the time he leaves school, say at fourteen or fifteen years of age, he has done much.

I have no time to contrast this ideal teaching of drawing with what the youth has probably had to undergo. I will but hint at the possibility of his having had no more instruction than he has been able to pick up during the usual lesson of three-quarters of an hour a week, when the so-called drawing teaching was given, when he had to get through a freehand copy kept purposely down to the 1st grade, or 2nd grade of difficulty, according to the Government examination he desired to pass. The only instruction he may have received when he had sketched his copy, according to his lights—which as to these subjects burn uncommonly dim in youthful minds—has amounted to little, perhaps, no more, than to be told his representation was too long or too broad or too something or other; not a word as to principles, nor proportion, nor construction,

no more than suffices to cram him for the Government examination. All one may say is that, perhaps, he is a little better off than if he had been educated at a higher middle class school, or private school, where the beginning and end of drawing is the picturesque pigstye of our youth, not altered in the least from the pre-South Kensington era.

The boy now has left school, and impelled by his instincts seeks occupation as assistant in the designers' room of some manufacturer, where designs enter into the work of the establishment; while working by day at some mechanical section of his profession, he seeks a School of Art, as the best means of supplementing his daily practice.

I am bound to say that in the majority of Art Schools he will receive an education of an excellent kind; the shortcomings of his early experience will be corrected and put right, or the good seed that may have been early sown will be encourged to fructify and develop with the growth of his character and his powers.

His training in ornament will now be very rigid and precise. The best examples of Italian work will be before his eyes, and his experienced teacher will point out to him the various principles that have been taken as the basis for the ornament he is considering, and using these principles as his text will discourse on the variations that are permissible or advisable, and test his instruction by giving the pupil varied practice in rearrangement and redistribution, and thus lead him to perceive the sources of the almost infinite variety in ornamental combinations that have been planned in the past, and lead to the natural deduction in his mind that it lies with him to form new combinations for the ornament of the future.

We may now imagine him to be learning the technical side of his calling in the best of all schools, the workshop, where the commercial instincts of his employers will be sufficiently developed to prevent waste of material, and to see that the shortest road is taken to the end in view.

Thus he may go on in his career, and either pursue his

work in the designers' room by day, and his general work in the Art School by night, striving to fulfil the demands of his employers to his profit and theirs; or he may, if he is industrious and has gifts of an ordinary kind, be selected for a national scholarship at the Central School at South Kensington. Now, with a moderate weekly allowance, he has every prospect of steady work for two years, and I will endeavour to put before you the career of this young designer while undergoing this portion of his studies.

The national scholar's week consists of five days and five evenings, the whole amounting to eight hours' work per day.

He is expected to attend certain lectures, to execute certain original designs, and to work diligently in the museum; and during the hours of the evening school to work from the antique, the life, or such higher art practice as may be necessary to strengthen his handicraft.

He will be taught to regard architecture in its largest sense as the basis of all design; therefore, on one morning in each week, the scholar is required to make ample notes of a lecture which is devised by the lecturer to secure a knowledge of :—

1. The Classic orders, their parts, construction and proportions:

2. The various modifications on these primitive orders brought about by the national developments in Italy, France, England, &c., especially the proportions and decoration of doorways, windows, and all openings:

3. The theory and practical application of mouldings:

4. Construction in various materials, various enough to suit the needs of the designer for stone, brick, terra cotta, timber, iron and other constructions.

This necessary training goes on to the end of the scholar's time, unless he can give evidence by an examination that he has sufficient practical acquaintance with this all important subject. I may add that he may present himself for examination at any time during the course, when if he should pass successfully, he will be exempt from further attendance on the lectures.

Next in importance is that he shall have a knowledge of the principles of ornamental forms. Those principles must be reduced to their simplest expression, and such details as they contain be in their turn subjected to the searching analysis of the lecturer. Therefore one lecture in each week is given on this subject, and notes are made in full, not only of the ample and facile sketches of the lecturer on the blackboard, but also on the running commentary which they illustrate, as well as the points of history which are needful now and then to a full understanding of the compositions of form or the symbolism of the ornament.

In this way in the course of two years he will have heard about 60 lectures on the principles of ornament, and 30 on architectural proportions, and will have quite sufficient knowledge to allow him to pursue the subjects thus treated of for himself, as well as experience enough to guide him in his selections for his note-book.

These class lessons are supplemented by a weekly lecture on the Æsthetics of Art History, that is to say Art in History is dealt with as it develops in national character, with the limitations to its growth imposed by national temperaments, creeds, or superstitions. In this course a large view is taken of the growth of art in all nations and peoples. It is a course extending over two years, and covers all the ground known to the latest reader in this large field of human activity. It doubtless tends to broaden the view and stimulate the reasoning faculty of the student.

Short courses of lectures are given on the chemistry of pigments and their influence on one another when used together. Questions relating to the durability of various methods or systems of decoration, such as fresco, water glass, tempera, oil, and water colour, are fully dealt with; and practical experiments illustrate the points dwelt on by the lecturer, and serve to give practical tests by which the ordinary adulterations of pigments may be detected. The effort of the lecturer is to equip the painter and designer with such safeguards against error that the

deterioration of his work may be guarded against, and to insist on such honesty of manipulation as may result in the absolute permanency of their work.

It is necessary to mention that sketch-books filled with square and ruled paper are supplied, which are examined and initialled weekly. And the scholars make sketches, and written notes of such objects in the museum as relate to the section of art or design they are occupied with. For instance, the designer for pottery, sketches such pottery or porcelain or stoneware, as will be of advantage to him when he returns to his home and occupation. The textile designer has his special notes. So with the iron worker, the furniture designer, the decorator, and so on.

But the most important organization for the designer's education is one I will now describe.

The lecturer takes his class on each Friday into the museum, and there explains the technical limitations that apply to a certain material; for instance, majolica ware, when the peculiarity of the body, the tin enamel, the colours, the reason of their granulated appearance, the directness of the work, due to the impossibility of retouching, the appearances due to the firing, &c., are all dwelt on.

This explanation enables the students to understand that something in majolica will be required of them on Monday, but until the subject is given out not one knows what definite demand will be made. The subject is described, the material is known already; then in the course of the day's work, the designs are made. The test is a valuable one, as it takes note of two points, one the intelligence of the student, and the other his readiness of conception and imagination. This exercise is repeated every week, with unmixed good for its result; for although it is no doubt important that a man should be thoroughly acquainted with the technical limitations of his own calling, it is also a valuable stimulant to his general knowledge, if he is made to think of the technical considerations that govern other materials than those he is mainly studying.

These exercises are then marked with twelve marks for

a maximum, which are apportioned thus: 4 for technique, 2 for use, 4 for ornament, 2 for execution of the drawing or model.

Those scholars who are modellers are required to model their designs under precisely similar conditions, and occasionally the whole class is asked to model some object that can be best expressed in plastic form.

It is worth while to dwell for one moment on the bearing that purely technical considerations should have in devising the education of the designer. It is frequently said that such and such a design in the National Competition would not work. The answer is, that it was never intended it should work; that it is an abstract composition, put together to try this, that and the other arrangement of colour or form. On the other hand, where a design is distinctly named as one made for a particular manufacture, these technical questions should be very closely considered. I claim for the system I have thus, in the greatest haste, described, that the technical considerations which enter into dozens of materials, are treated of, impressed on the students' minds, and rewarded with marks adjusted to record the intelligence with which they have observed the various constructive points that arise and are commented on during the round in the museum and in the lecture room, when the subject is given out.

Add to this special training occasional competition for money premiums offered by publishers or manufacturers, or others, who occasionally make use of the school as a means of obtaining designs for their manufactures, and further, the daily practice from the figure, and you will see that the national scholar of to-day is in a fair way, one may hope, to learn his calling thoroughly.

I admit that the technical considerations that attach to some trades are difficult to demonstrate without free access to manufactories, but I hope I am not too sanguine when I express a wish that the day may soon come when the advantages that will surely be developed in the great Institution in which we now meet, may be shared by the

students of the National Art Training School, that there may be a generous reciprocity between the two great schools.

Next as regards the teaching of colour.

In the largest sense Colour cannot be taught—the colourist is like the poet, born not made. A good colourist may be trusted with any colour box ever put together by science. He will, while still young, do everything that is right and nothing that is wrong, and will be wholly unable to say why he does it. The man with no feeling for colour cannot originate what is very right, but he may be saved from what is very wrong, by the knowledge of a few of the most obvious laws of colour. These should be demonstrated in a short course of lectures with practical examinations in colour, as the test of intelligence, at the end of each lecture. But when all is done that can be thought of, the educated product may be wholly deficient in the one quality that determines his position in the world of art. He may lack taste ; another great natural gift that renders wrong principles in ornament endurable, makes colours that are theoretically wrong delightful, and when combined with all that the majority of ornamentists recognise as right, gives the possessor of the gift the power of originating combinations, of creating new styles or new adaptations, and as far as his section is concerned, moves the education of the world on one step. No method of study can endow everyone with taste. If it is found in a student the greatest care should be taken not to spoil so precious a gift, but to cultivate it aright.

Another question involved in the education of the designer is: What are we to do with him after he is educated?

In this country only a certain and comparatively a limited demand exists for good art work. Good art work can be produced by manufacturers, but it may not sell. Does not this point to over-production, and that our designers are in advance of their patrons ?

When the average wage of skilled wood carvers is 40*s.*

per week, and capable and trained designers rarely obtain more than 60*s*., when the architect's contractor lets out the carving of gothic capitals at 5*s*. each, and when designs are frequently mutilated by the manufacturer to suit the taste of his customers; it is no matter for wonder that men of taste, who have had a good education in the handicraft of art, should apply themselves to any or every branch of fine art in which they pursue their own bent, and are the sole judges as to what is necessary for the thorough working out of their design, especially when they receive better remuneration, and, further, have the reward of feeling that their work delights thousands of admirers, as it certainly does when it is presented in the *Graphic*, *Illustrated London News*, or similar publications.

Nevertheless I hope, and believe, a better time is coming. The vagaries of fashion seem less violent; there is in the country a large and appreciative buying public, and its numbers augment every day. The action of the Art Schools, and the instruction conveyed in them, the opening of Art Museums, and many other influences, must tend to the development of better taste in the consuming classes in this land, and lead to that best of all results, a steady, solid wholesome growth of demand for better and more beautiful productions.

APPENDIX I.

COURSE OF LECTURES ON ARCHITECTURE.

By H. B. Hagreen.

The orders of Architecture drawn to a large scale upon the black-board by the lecturer who explains the proportions and details of each order, the students making careful copies of what is done. The capitals being the most important features, drawings of these are made in perspective from large casts in the class-room, arranged so that they can be placed in any position.

Grecian Doric	2	Lectures.
Ionie	3	"
Corinthian	3	"
Roman Doric	3	"
Tuscan	2	"
Ionic	3	"
Corinthian	3	"
Composite	1	"

Modifications of these orders as seen in

Italy 2
France 2
England 1

The proportions and details of important features in different styles, such as doorways, windows and other openings, showing the possibility of great variety of design without losing the intended character and consistency of the whole composition 5.

APPENDIX II.

CLASS LECTURES.

By Hugh Stannus.

Lectures to general students on Mondays on the Elements of Pattern-designing, and the Treatment of Natural forms.

Short courses on each of the following subjects :—

1. Elements of Ornament.
2. Conventional Ornament.
3. "Starts" in Ornament.
4. Distribution of Ornament.
5. Borders.
6. Bands.
7. Friezes.
8. Diapers.
9. Radiating Ornaments.
10. Free Ornaments.

11. Plant Form in Ornament.
12. Colour.
13. Subjects for Surface-designing [periodical].

Lectures to Masters in Training and National Schools on Tuesdays, on the Principles of Design, the Treatment of Relief and Solid Designs, and Technical Design.

Short courses on each of the following subjects:—

1. Principles in Ornaments.
2. Methods of Applying Ornaments.
3. "Animal Starts" in Ornaments.
4. Profiling and Enrichment.
5. Architectural Features used in Designing.
6. Properties used in Designing.
7. Theory and Practice of Decoration.
8. Sub-panelling.
9. Modelling.
10. Composition of Line and Mass in Panels.
11. Human Figures Decoratively.
12. Figure Composition in Panels.
13. Sculpture with Architecture.
14. Technical Treatments.
15. Data in Design.
16. Subjects for Solid Design [periodical].

APPENDIX III.

FORTY LECTURES ON THE HISTORICAL DEVELOPMENT OF ORNAMENTAL ART, WITH GENERAL REFERENCE TO ARCHITECTURE, SCULPTURE PAINTING, AND THE PRINCIPLES OF ÆSTHETICS.

By Dr. G. G. Zerffi, F.R.S.L., F.R.Hist.S.

FIRST COURSE.

Lecture I.—Introductory remarks. Archæology, History, and Æsthetics treated scientifically. The three principal groups of mankind, and their artistic characteristics.

LECTURE II.—Pre-historic Art. The old and new Stone, the bronze and iron periods. Caves. Huts. Dwellings on piles. Weapons and pottery.

LECTURE III.—Savage Life. New Zealand. Mode of ornamentation. Ancient Mexican Art. Temples, pyramids, and sculptures. Causes of the want of symmetry in Mexican ornamentation.

LECTURE IV.—India. Religion and Art. The Vedantic and Brahmanic periods. Abstract and concrete embodiments of the phenomena of nature.

LECTURE V.—Manû and his laws. Castes. Brahmanism and its influence on Indian Art.

LECTURES VI. and VII.—Buddhism. Rock-hewn temples. The caves of Ajunta, Ellora, and Elephanta. Sculpture, and mode of ornamentation.

LECTURES VIII. and IX.—Persia, Assyria, and Babylon. Palaces and temples. Nineveh and Khorsabad. Slabs and their ornamentation. Weaving and colouring.

LECTURES X. and XI.—Egypt, aspect of nature. Land and people. Mode of writing. Holy Books. Mythology. Menes and his court. Architecture and sculpture. Mode of ornamentation. Pyramids and temples.

LECTURES XII. and XIII.—China and Japan. Land and people. Literature and religion. Confucius. Laò-tsé. The Imperial palace at Peking. Tea gardens. Mode of ornamentation. Colouring. Silks. Porcelain. Carvings. General principles of Chinese and Japanese ornamentation.

LECTURE XIV.—Causes why neither architecture nor sculpture, nor a refined ornamental art, could be fully developed in Asia and Africa.

LECTURES XV., XVI., XVII., XVIII., XIX., and XX.—Greece and the Greeks. Aspect of nature. Social and political organisation. Epic, Lyric, and Dramatic poetry. Mythology and Philosophy. Altars and temples. Principles of architecture. Different orders of temples. The Akropolis at Athens. The Parthenon. The temple of Theseus. The temple of Poseidon at Pæstum. The temple of Apollo at Miletus. The Choragic monument of Lysikratês. The Mausoleum of Halikarnassus. Degeneration of the pure and severe Greek style into an over-decorated oriental style of architecture and ornamentation.

SECOND COURSE.

Lectures XXI., XXII., and XXIII.—Greek plastic art. The periods of the gradual development of Greek sculpture. Dædalus and Endæus. Dipærus and Skyllis. Smilis and Bathyklês. The schools of Ægina and Onatas. Kalamis of Athens. Pythagoras of Rægium. Myron. Phidias. Agorakritos, Alkemenes, and Kallimachus. Praxitelês, Lysippus, and Skopas. Gradual decline of Greek sculpture and its causes.

Lectures XXIV. and XXV.—Etruria and Rome. Tombs and burial places. Bronze works. Ornamental Art. Temples. Palaces. Theatres. Baths. Public and private buildings and their ornamentation. Mosaics and wall paintings.

Lectures XXVI. and XXVII.—Christianity. Mysticism and Symbolism. Early Christian architecture, sculpture painting, and ornamentation. Plans of Churches in the East and the West. Plotinus and his æsthetical principles. Spiritualization of matter and Art.

Lecture XXVIII.—The Nomadic tribes of Arabia. The Caaba, Mohamed. The Koran. Art in the East. Mosques and Palaces. Arabesques. Mohamedan Art in India, Persia, Egypt, Asia Minor, and Spain. Characteristics of Mohamedan Art in general and in detail.

Lecture XXIX.—The Teutons. Ostrogoths and Visigoths. Saxons and Franks. Their mythology. Their ancient monuments and mode of ornamentation. Tombs and places of worship, weapons and accoutrements, customs and manners, houses and castles.

Lectures XXX., XXXI., XXXII., XXXIII., XXXIV., and XXXV.—Ecclesiastical Art in its progressive development. Byzantine and Romanesque principles. Origin of Gothic Art. The four principal periods of Gothic Art. The Cathedrals of Poitiers, Reims, Chartres, Rouen, Canterbury, Amiens, York, Westminster, Cologne, St. Stephen at Vienna, Wells, Salisbury, Lincoln, and Durham. Sculpture and ornamentation of Gothic Churches. Sacred and profane buildings. Furniture and textile fabrics. Inventions and discoveries, and their influences on Art.

Lectures XXXVI., XXXVII., XXXVIII., and XXXIX.—The different periods of the Renaissance. Cimabue. Giotto.

Holbein. Donatello. Lorenzo Ghiberti. The principal Elements of Modern Art. Art in France, Italy, England, Germany, and Spain. The Museums of Europe and their arrangement. Cornelius, Schrader, and Kaulbach. Influence of lithography and photography on Art.

Lecture XL.—The Tree of Art in its origin and growth. History as the basis of a thorough understanding of Art in all its branches. General principles of a correct ornamentation. Conclusion.

N.B.—The lectures will be illustrated by photographs, diagrams, maps, plans, and sketches. Students are recommended to provide themselves with note-books for pencil outlines and memoranda. Time will be allotted at the end of lectures for the examination of such note-books as are handed to the lecturer.

Students in training and national scholars will submit their note-books to the lecturer, who will examine and initial them.

APPENDIX IV.

SECOND COURSE OF SIX LECTURES ON THE CHEMISTRY OF PAINTS AND PAINTING.

By A. H. Church, M.A.Oxon., F.C.S., F.I.C.,

Professor of Chemistry in the Royal Academy of Arts.

Lecture I.—The chemistry of Fresco and Tempera-painting.

Lecture II.—The chemistry of Water-colour painting, and of Stereochromy, old and new.

Lecture III.—The chemistry of Oil-painting and Spirit Fresco.

Lecture IV.—The lessons to be learnt from old pictures and drawings.

Lecture V.—The varnishing, mounting, framing, and conservation of drawings and paintings.

Lecture VI.—New materials and methods.

ON THE TEACHING OF DRAWING AND OF COLOURING AS A PREPARATION FOR DESIGNING AND DECORATIVE WORK.

By A. F. Brophy,

Finsbury Technical College.

In the following paper I will try to describe the most direct method of teaching a student how to draw, and as to colouring, the best method of receiving instruction from nature.

Drawing is all important—to draw is to create. Drawing is both the body and soul of Art. Colour is but the garment an artist's creation wears.

Every field and hedgerow presents numerous suggestions for arrangements of colour, from the most varied contrasts to the most subtle harmonies, all beyond the definition of a rule, and defying classification in the infinite varieties of their blending hues. And every colour—obeying the great law of fitness of tone for its position—gives the very best lessons towards regulating schemes of decoration. Colour in decoration is entirely subordinate to drawing. A student whose observation has impressed him with the characteristics and beauties in all that he daily sees around him in nature, has prepared a mind in which a practised hand will find inspirations when he has learned to draw. From the very first entry of the elementary student into the class, you must try and impress him with the idea that every drawing, even his first, should be a complete work in itself—a training to the hand and mind—a work executed with care and interest, one in which the student not only receives a lesson in the imitation of form, a lesson in *technique*, but one in which you give him an opportunity of exercising his invention. This idea always being kept before him—*that no*

matter what the material is in which he happens to be a worker, it will entirely depend upon himself, his power of expressing through drawing any idea of interest brought into his scheme of decoration or ornamentation, whether his work be a work of art or not. Upon these lines only can any scheme of teaching that pretends to help our industries be successful. You must love your labour to do good work, and you must think your work worthy of all your labour, and capable of becoming a work of art, to love it. I think there is no greater mistake, or one more calculated to injure our industries, than that a system of teaching should be adopted in our technical schools that hope to educate decorative artizans, which would elect to make students try for what may be called one of the Fine Arts, Picture Painting, making this the climax of their ambition—sacrificing the many for the sake of the few, who could transfer their work executed *in the Schools* from their easels, to the walls of an Academy Exhibition. It is said that unsuccessful picture painters fall back on decoration; but the mischief remains that those who turn to decorative industrial work would do so broken-hearted, labouring under the stigma of failure. They will never make good artizans, their heart will not be in their work, they will hope for the day when their attempts at pictures, like the works of their more talented fellow-students, taught under the same system by the same masters, will once more be side by side on the walls of an Exhibition as they were in the days of their studentship in this schoolroom.

When our artizans are true to their name art-workers, and when the public are educated so that they appreciate their efforts, then we may hope for art-work that, produced to-day, will be fit to place side by side with the best of the old masters in our art museums. This can only be achieved by the simultaneous education of both classes—those who make, and those who buy. The purchasers, or what is called the non-industrial class, should have lectures delivered to them illustrated by examples of the best art-workmanship in different materials. I think a great

impetus would be given to this if our Art-masters throughout the kingdom were allowed to reap the same benefit for teaching *Art Design* to the non-industrial as they do to the industrial class. I consider the policy short-sighted that encourages one and not the other. It is the educated man who supports good art, not the ignorant. I know of one industry that has a lecturer who takes with him from one town to another the best samples of old lace, and lectures to both these classes, the industrial whom he visits in their work-rooms, and the non-industrial to whom he explains, by illustrated lectures, the art and history of lace, showing by reference to good old examples their beauties of design, thereby sowing the seeds of knowledge, which have already taken root and promise to blossom into commercial prosperity.

To describe the teaching of drawing and colouring to the student who is to become a designer and decorator, which is the principal object of my paper, I will try and give step by step his progress, the work which he will be required to execute, and the materials in which he will execute it, so that he shall have an idea of what drawing is, and how to observe colour.

I divide a student's training into three periods. The Elementary, the Historic, and the Practical.

The elementary class period, which I think the most important, because of the difficulties to be overcome in capturing the student's whole attention, above all things not allowing him to feel his first work is a grind at something that will prepare him for art-work, he must feel that he is engaged in making use of the material, acquiring the power of developing bye and bye his own invention and feeling. To accomplish this, place before him an outline drawing of some simple form, directing his attention to what the copy is—an illustration of which he is to make a note—then cause him to sketch it the correct shape. The best material he can use to do this is willow charcoal, because of the freedom of line, and the ease with which you can both sketch and erase. When the form is

declared correct, you teach him how to hold and use a brush. The student now exercises his own taste or fancy in filling in the form with some colour or colours. This brings all the student's powers into play at once. He feels, when the form is declared right, the pleasure is in store of exercising his own judgment in selecting the colours and the finishing with brush outline, he gets a completeness in his work that becomes with him a habit through his career, he even learns from his failures what to avoid, above all he learns to *finish his work*.

The examples to use in this class are copies in outline of objects in the South Kensington Museum or other art collections, a description of which is printed on each copy; and if the object represented is a piece of ornament that illustrates a style of ornamentation or specially marks a date, it is so stated on the example, so that the copy at once becomes a study for the hand, information for the mind of the student, and also from his being taught how to hold a brush and lay a tint, this becomes his first lesson in what may be called the *technique* of painting.

During this elementary period, the student is required to attend class lectures in geometry and perspective—the geometry to instruct him in methods of striking out geometric patterns, and perspective to prepare him for the next step in his teaching—drawing geometric models.

The first group of models that is put before the student should be so placed that it will be easy to point out the application of the primary laws of perspective just learnt. For the purpose of correction, I have found the very best method to adopt is to have a large sheet of glass that can be placed between the student's eye and the group of models, of which a freehand study has been made. On the sheet of glass there is a correct perspective drawing in white outline. This will help to correct the freehand study, and show by ocular demonstration the correctness of perspective theory.

The student, in working from these models, in every case works in some material that is identical with one that has a place in the industries.

No time must be spent drawing or shading in a material that is used for the sake of *school practice only*. Why should not a student learn the art of light and shade in a material that he may have in his hands every day? I maintain there is no industry in which any artizan has to work in which you cannot find some material in which he can be taught elementary art from the beginning.

When, with a knowledge of drawing and painting in some material, the student leaves the elementary, and enters the historic ornament class, the best examples of the different styles are placed before him, to both draw, colour, and paint in the same material as the original, if possible. The first thing is to explain to him the art or beauty of the example, where it was used—whether as a piece of decoration it stood alone, or whether it formed a background for some other object, because its position has determined its treatment ornamentally.

If the decoration be a scheme of ornament that by repeating one motive becomes a diaper, then its consequent breadth of treatment must be explained to him, the necessity of accuracy and exactness of the repeat, so that each one will register in its proper place, and the part that the spaces between the ornament play in the effect of the whole treatment pointed out.

In the study of historic ornament that refers to diapers, attention should be drawn to the fact that they are always subordinate, and take their places as backgrounds, that their design and colouring are suitable to their position. The design by repeating one motive only, not calling for any special attention, and the colouring by being in tones of one colour or in colours so nearly allied in value, giving great breadth of treatment that will not attract from any object in front.

The next step will be to copy ornament that often, in strong contrast with the ground on which it lies, is dependent on its contour for its beauty. This class of ornament, which stands by itself, is of a higher grade, and having in it an evidence of life or growth, must have its character explained in copying. The correct feeling of the ornament

is only to be obtained by the student working in precisely the same way as the original inventor, consequently in correcting the work much more stress must be laid on the life and growth of the different parts—their character in the details being felt—than their relative exactness of size or proportion.

To explain this most important part of my system, I will take for example a piece of Italian arabesque ornament, with scroll and subject introduced. The student sketches in charcoal the size of subject panel; then, in striking the scroll, he is allowed a slight latitude in the size, so long as he draws that scroll with the same grace and with the same feeling as the original. To exactly measure, or even measure in an increased or diminished proportion, to obtain by precise points the exact position, through which must pass, all the details of this scroll, will be to prevent the possibility of the drawing having the same grace or elegance, the work will look laboured and cramped, lack the go or vitality of the original. *No ornament gives such pleasure as that which seems done with ease.* Time spent in obtaining mathematical exactness in free-flowing ornament is misspent. The sooner the pleasure of drawing ornament quickly is felt, the better.

The lectures in technique in this class must be carefully given; *the amount of work or finish in the ornamentation applied to each material depending on the coarseness or fineness of texture, and the processes through which the object has to pass.* This should be shown the student and illustrated by reference to good old examples, in which their qualities have not only governed, but even created the style of ornamention. Before leaving this class, I would have all students to feel the necessity, when studying from ornament, to do so in a material in harmony with the subject—to attempt to copy the large rich foliage of the Roman scroll with a fine wire line, or attempt to render delicate light and shade examples, except the light and shade, is bad practise.

With these lessons the student is now in a fit state to

receive the instruction in the advanced class that will complete his training.

In this, the latter period, to which I have given the name of practical, I only wish to give this especial name, because here, by bringing the student face to face with Nature, I want him to acquire that knowledge and creative power that will so store his mind with material drawn from the life, that the filling of a space with appropriate ornament becomes to him an instinct, and he has merely to be given some object whose manufacture he understands to beautify it. Clothed either with new beauties of ornament that will emanate from his own mind, or in applying ornament that has a known character or style, to so apply it as if it was originally created for the object immediately before him.

Here also the charms of nature's colouring, always varied, never an exact repeat, changed to suit every position, are carefully noticed.

The student commences the study of nature by having placed before him a plant in flower. In a given time he will be required to make this study. To feel its precise value as a scheme of colour, he will have to execute this on some neutral background, white for choice. In the drawing he will be instructed to, above all things, catch the growth of the plant, how the leaves and flower spring from the stem, and in drawing the flower, how the different petals spring from the centre. Let the brush with which he draws suggest this growth even in the *drawing*. Let him not stop for exactness of size. Time, which is important in the drawing of plant forms, will be lost; also, there is a risk of losing what is more important still—*the feeling of life or growth*. A flower, a little different more or less in size, can still have the correct character, so also with a leaf, or group of leaves. The student now has the scheme of colour that the plant suggests pointed out: how the stems with their leaves and their varying tones of green take the place of a harmonious background to the flowers; how these flowers themselves, often suggest arrangements of colour. What can be more beautiful than that given by a pale yellow

rose, with its various tones from pale to deep rich gold, the centre giving those few touches of purer and more positive colour that are just wanted to make the scheme complete without disturbing the harmony. Here is a lesson for application. Take the flower, a harmony in yellow. This by careful study reveals the fact that although the harmony is complete every tone of yellow differs, still yellow is felt throughout as the predominant hue or colour. From the flower alone an exercise should be insisted on, the two conditions of all decoration work being given as the bases, one in which it is required to design a panel *as a background* with a repeat of the plant giving the ornamentation as an arrangement in yellow, the other exercise a decoration that *not forming a background* shall have to stand by itself, an ornamental treatment of the plant.

This practice will serve as better lessons in colours than attempting to make all decoration subject to a rule that insists on the presence of the primary colours in certain relative proportions, a rule which if carried out would condemn those beautifully decorative treatments—a peacock blue room—a gold room—a grisaille plaque, or a Henri II. candlestick, treatments, all of which are both beautiful in design and colour. Any rule would have to change every time the conditions varied, which would give a rule subject for every particular condition or position in which a decoration was placed. This would end in nothing but confusion. *The sense of fitness for its position seems to me the only general rule that can be laid down for all decoration, whether coloured or not.* For example you may want to give a cheerful or brilliant tone to what may be a dark or badly lighted room; or, on the other hand, a room that is so constructed that the sun is continually there may want subduing. Again, you may have some gems of art-workmanship that you wish to show to the greatest advantage; the coloured scheme of decoration used behind these can be so toned that the eye is satisfied that nothing interferes with the objects on which you wish to be able to concentrate all your attention; or, again, you may want in

some hall or passage to the principal rooms, to make the ornament the complete decorative finish of that part: here ornament that asserts itself by strong contrast, and is pleasant to the eye by its beauty and variety of line, is evidently the right one for the position. Yet these ideas can only be put as suggestions. The artist's mind must conceive and carry out what is evidently appropriate, suiting his colour to the requirements of position.

The next step will be to acquire a knowledge of animal forms, their actions studied from life, so that the student can use them in whatever position in his composition he pleases. Now, versed in all the difficulties of the *technique* of the material in which he is working he approaches the study of the human form, that is, and should be, the crowning knowledge of every ornamentist, and without which he can never give to any composition that interest which awakens the emotions. I would have him first draw the extremities—life size, or as near life size as possible—filling in the bones and muscles to the different parts, than attempting whole length figures, executed in a given time, varying the exercise by making small studies of the figures in motion. These studies should be painted in tones of one colour; this would make the exercise one in drawing alone, colour being used to carry it to its utmost limit. When the student can make a complete study of the human form from the life, I would place before him an antique statue, that he might work from an admitted perfectly-proportioned figure; then, on his return to the life class, I would require him to execute drawings of draperies on the figure, always trying to finish his study in the one sitting, varying the practice again by endeavouring in rapid sketches to catch the movement of draperies on the figure in motion, aiming in all his attempts at perfect draughtsmanship. When a student can draw the human form, some exercises in composition should be given him, to be wrought out in monochrome. Where the figure is used, either in combination with ornament or by itself it should be so designed, that the action which he wishes to convey is

evident in the composition; the principal lines or masses leading up to it to give the required impression in all its strength, sacrificing the details for the sake of breadth. The value of this quality has been the strongest argument in determining that the student must work in monochrome.

The lectures to this class should be on the forms of animals, their habits and actions (assisted by instantaneous photographs), the anatomy of the human form, lectures on the different phases of the antique, also the impressions the best allegorical figures of the Renaissance give of action and repose. These lectures would be greatly enhanced, by a supplementary course on the mythologies of ancient Greece, Rome, and Scandinavia, which, when understood, can be seized as part of a decorator's store, to add materials that would give interest and charm to his inventions. In this way we may hope to produce not only a thoughtful designer but a decorative artist.

The highest art is that which contains the greatest thought combined with the greatest technical power.

In the many suggestions I have made for teaching Drawing and Colouring, I have kept within what I consider the true lines of instruction, in what may be called Technical Art.

DISCUSSION.

Mr. T. C. Horsfall, in opening the discussion, said:—Mr. Chairman, ladies, and gentlemen, I propose to confine my remarks to one part of the subject which has been dealt with in the very able and interesting papers we have had the pleasure of listening to, that is the appreciation and the right use of colour. I think that Mr. Sparkes and Mr. Brophy both underestimate very greatly the need and the usefulness of training in the right appreciation and the right use of colour. I do not think that one can study art, especially in those parts of the world where colour has

been used with striking success, as in Venice, without coming to the conclusion that there is a far more certain and fixed relation between the mind, the brain, or the nervous system and good colour, than one would infer from such a statement as that of Mr. Sparkes, that the right use of colour depends entirely on that thing called "taste," about which we are taught in early life that there is no use disputing, because it seems to be regarded as a set of capricious likes and dislikes. I think that it is quite certain that the relation between good colour and our nervous system is as fixed and as capable of development as the relation between certain combinations of sound and our nervous system, which makes those combinations of sound pleasant and musical, whilst others are disagreeable and unmusical to almost everyone who has received a sound musical training. We have not yet had a Helmholtz to show us the physical basis of pleasant colour, but then it is only a very few years ago that we had a Helmholtz to show us the physical basis of musical sound; and I do not think that it is over boldness to say that it is almost certain that our own generation will see the rise of a Helmholtz who will point out to us that there is a physical basis for good colour. There is, I think, no doubt that it is so. How else could it be that most of the pupils of a Titian show a far greater love and mastery of beautiful colour than is found in the Florentine school, and certainly than has been found in any part of modern Europe? There is another encouraging fact—that those English people who have given a good deal of attention to the study of colour have arrived at practical unanimity with regard to the pleasantness of certain combinations of colour. I think that the fact which underlies the statement of Mr. Sparkes, is that susceptibility to rightness of colour is a quality that can be gained only to a marked degree at a much earlier period of life than that at which students enter schools of art; and I base that statement on the fact that it is only a few years ago that we accepted without doubt the statement that was made so often—that a very large proportion

of the human race cannot acquire the art of singing correctly, and that a very considerable proportion cannot even acquire the art of finding music pleasant. It is now known with the utmost certainty—a certainty based upon careful observation—that in a thousand children there are not half a dozen who, if they are taught carefully in very early life, cannot gain susceptibility to beautiful music to a sufficient extent to enable them to sing correctly and to take pleasure in music. I make that statement on the authority of the late Mr. Hullah, who made it to me some years ago. Susceptibility to rightness of colour will be found, I am sure, to depend entirely upon the training of children before their nervous system has formed the bad habit, which it very soon acquires, of not noticing differences between good and bad colour. It is a question to be dealt with before young people enter schools of art. It is a question to be dealt with in our elementary schools. The opportunity which is presented by the elementary schools is shockingly neglected. In a few schools an attempt is made to give some knowledge of colour, but the abominable aniline colours which are admitted to be the ruin of good art all over the world, and which are now exported to India and used there, and to Japan, where they are ruining the colour sense of the Japanese, are almost universally used in primary schools. You see a number of shades of staring scarlets and reds. Susceptibility to goodness of colour must be given in primary schools, and I rather regret that an authority so deservedly highly respected as Mr. Sparkes has not perceived that fact and called attention to it in the admirable paper to which we have just listened.

The CHAIRMAN (Mr. MAGNUS): I thought that it might suit our convenience better to separate the discussion on technical art teaching from that on the best method of teaching drawing in elementary schools, but Mr. Horsfall has shown to what an extent these two subjects are naturally blended; and under those circumstances, with your permission, I will ask Mr. Ablett to read his paper before the discussion proceeds further.

THE TEACHING OF DRAWING AND OF COLOURING AS A PREPARATION FOR DESIGNING AND DECORATIVE WORK.

By T. R. Ablett.

Mr. Chairman, Ladies and Gentlemen:—It is with considerable diffidence that I approach the subject upon which, at the invitation of the Committee, I have undertaken to read a paper. Great industry and skill have been employed in the study of the decorative work of all ages, and have produced an almost exhaustive illustrated literature of elucidation and explanation. We have been furnished with a museum of ornamental art, which is the pride of Englishmen and at once the admiration and the envy of the foreigner. Connected with this famous museum we have a system of training for designers and decorative artists, of which thousands upon thousands of aspirants to artistic distinction have availed themselves. Surely with such advantages the art teachers of the present day must have reached that perfection in their methods for which all artists should strive, and it has become quite unnecessary to say anything further on the subject. To teachers who already feel overburdened this is a comfortable view to take. Unfortunately for the enjoyment of repose, there are those who are active in the propagation of new ideas. A celebrated architect recently assured me that our system succeeded only in rearing a race of artistic pigmies. Some who have had the training we give speak of it as a grind, and profess themselves quite unable to recommend their friends to try it. A celebrated writer says of us, "Had teachers been guided by nature's hints, they would have done still better than they have done."

Is our system adapted to our pupils, or are we in a position similar to that which the son of the Vicar of Wakefield occupied when he went to teach the Dutchmen English, without himself knowing any Dutch?

The great majority of children delight in pictures, and seek, some time or other, a means of pictorial expression which will satisfy their wants. Why do we give them practice in outline only? Nature does not display her charms by means of outlines so much as by masses of light and shade, tone and colour. Can we not find means for enabling the young to easily reproduce those beauties which attract them, instead of insisting on the exclusive practice of drawing form in outline for which they do not care? If it be true that nothing is of the least use to young children but what interests them, should we not leave the development of technical skill to arise naturally from a delight in the practice of painting?

There can be no doubt but that the vast majority who learn under our present system lose their zeal, and never come by any of the power in pictorial expression which their inclinations led them at the onset to seek.

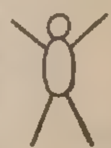
It seems as though the art-worker's genius were a delicate plant which seldom survived our well-meant attempts at cultivation.

We teach writing and elementary drawing by two different methods of making a line:

Continuous line used in writing.

Broken or painted line of drawing teacher.

In spontaneous attempts in outline drawing, the very young use the method of making a line employed in writing. Each separate idea or perception of form is represented by one effort of the hand. In drawing a man, for instance, a circle is swept in for the head, an ellipse for the body, and a straight line for each arm and leg. The finished artist sketches on a similar plan, for each stroke is the record of one observation.



May we not discard the use of a broken or painted line,

seeing that the drawing, which we term writing, is executed with the continuous line natural to the child and the finished artist?

Very young children have keen perceptions. Their difficulty in representing form is chiefly that of finding a medium which will obey the hand with readiness and ease in its attempts to give expression to the perceptions of it, in themselves tolerably correct.

If we supplied the readiest means of recording these perceptions, children would display much greater skill than is now thought possible. Perhaps the finger swept over loose sand, supplies the easiest method of delineating very simple shapes, and the brush follows the movements of the hand more readily than any other of the artists' tools. Should we err in allowing early efforts in writing and drawing to be made first on sand and then with the brush?

It appears that in Japan a boy begins to learn to write at six years of age, using for the purpose a brush as large as the little finger. In the Government elementary schools, about three thousand different characters are taught. The Japanese artist learns to draw as he learned to write. This connection between writing and drawing is supposed to have greatly conduced to the artistic power of the people, and to have brought about their surpassing skill in handling the brush.

If a system of teaching elementary drawing can be established which will keep up and develop zealous practice in pictorial expression, for which so many young people show a strong inclination, it will be worthy of support on that account alone, for it will have succeeded where our present system has hitherto failed.

Let us consider how the teacher of advanced drawing should deal with those who come to him with enthusiasm and that skill which is the product of spontaneous effort.

Art students are human beings. Let care be taken that advance in technical skill be not gained at the expense of enthusiasm, and all the possibilities it brings with it, or by reducing the intellect to a stagnant state. Art training

should be regarded as a privilege and not a punishment.

What is the value of the dreary discipline of copying lines known as Freehand Drawing? This form, when uncoloured, is typical of those from which practice is given.

Originally it was drawn by a Greek decorator with the brush direct, simply because it was an elegant shape which the brush is admirably adapted to make. Will drawing it in outline with a lead pencil give a student any conception whatever of the aptness of the original design or any of the technical power the Greek enjoyed? Little pleasure is to be found in copying the dazzling combination formed by tracing only the outlines

of brush markings compared with the joy of using the brush in marshalling in pleasing array the forms it readily lends itself to depict. The use of the brush stirs the intellect and calls out the inventive faculty at the onset of a student's career. Freehand! What freedom does a lead pencil give compared with its facile colleague the brush.

The easy transition between the arts and the trades, which the Greek use of the brush illustrates, may be opened up in other directions if the drawing class and the workshop be brought into closer connection. When the teachers in elementary schools become able to train, to the best advantage, the young enthusiasts in drawing entrusted to their care, we shall have a number of suitable candidates for the scholarships which it is to be hoped will be presently established. The connection between the drawing class and workshop will be complete if the holders of these scholarships work at the drawing class half their time and at the shop the remainder, in fact if they become half-timers. The limitations in design brought about by the nature of a material, the kind of execution required, and the necessary methods of manufacture, should become familiar to the young art workman at an early age. The stage limits a player's action in certain ways and requires a

certain style of declamation. No actor can rise to great eminence unless he learns while young to adapt himself instinctively to these necessities. Early experience in the shop should enable the art-workman to become equally successful in designing without the appearance of restraint. It is possible, without the expenditure of much time or energy, to train up art-workmen of the greatest skill by imparting to them, in the most economical way, simply that which they require for their particular industry. Perfect skill in workmanship, combined with the power of inventing the most suitable design, tends to reduce the waste of material and labour to a minimum, and so to bring about an economy which benefits both the producer and the consumer or user.

Time! Is that of no consequence in art-teaching? The earlier a student obtains command of his materials the greater number of years he will have in which to develop and give expression to his ideas. Science teachers by means of a set of experiments demonstrate a principle or fact to a body or class of pupils. They do not fritter away the hours of school-life by giving a separate demonstration to each pupil. Can we not secure a like economy by placing our casts or objects so that a number of pupils will have approximately the same view, and by demonstrating methods of work and principles, with the members of the class following step by step? Will not the principles of model-drawing, shading, painting, figure-drawing, designing, and modelling lend themselves readily to such treatment? Surely they are definite enough for demonstration with something like scientific accuracy. Some half-dozen antique figures are drawn over and over again, year after year, by our students. Has no one yet discovered a method of representation that may be readily communicated to a set of students?

Soon will art teachers have to justify their existence to a cultured nation. If they cannot show that their work is based on principles which make an appeal to the intellect it will surely stand condemned.

Genius is said to be the capacity for taking infinite pains

in trying an endless number of experiments. Can we not save genius that waste of energy which the discovery of things already known entails, by taking care that the processes and knowledge common to the majority of art-workers shall be readily attainable?

Class-methods of instruction bring with them many advantages. The most obvious gain to the teacher is the economy of time. Twenty students studying individually require twenty separate statements of the course they are to pursue. The same individuals, working in class, require but one statement. Again, the conditions to be observed in the presence of an audience induces the teacher to map out a course of work with care, and to arrange his statements in such a way as to appeal most strongly to his listeners. The benefits to the students are even greater than to the teacher, for the principles of co-operation are brought into activity. Brown sees Jones overcome a difficulty which he thought the master only could cope with, and straightway he vanquishes it himself. Jones gets an idea which Brown carries forward, and it becomes a point of new departure for the whole class. Have we not had too much solitary confinement in English art? We hope for the rise of a national style in ornament. Is it not likely to grow up from such co-operation as it is the peculiar province of class-teaching to invoke?

Art-teaching would gain much if the organisation of an art school were more like that of a good day school. There is no reason why it should continue to be deprived of the advantages which arise from division of labour in teaching, variety of work, and above all, a good time-table. Co-operation among the teachers of provincial art schools would open up great possibilities of development.

The neat stringing together of a certain proportion of eyes, arms, biceps, patellæ, and the like, is scarcely sufficient to express the life and energy of a human being. How is it that in English schools we hear so little said concerning the action of a figure? Should we become able to draw and teach the drawing of the human figure as well as our

friends across the Channel, still we cannot continue to neglect the drawing of the forms of animals. It is a curious fact that we have no casts of animals of any value for the use of students, and it would appear that the introduction of a live animal into a school, for the students to sketch from, has never been attempted. Yet the forms of animals have been made use of in many of the best historic styles of ornament, and we have some of the finest animals the world has ever seen in England of the present day.

Sketching clubs are little heard of among our designers. This is surprising when one thinks of the world of beauty that exists in our fields and hedgerows, and which is capable of furnishing abundant material for many excursions. Of this there can be no doubt, that the inventive powers are likely to be more active when supplied with material fresh from nature's bosom than they can become when stimulated only by the prints in books on botany, or by sketches stolen from the work of the dead past. The lovely forms of many of our wild plants and flowers have never yet been worthily translated into the language of the decorative artist. The beauty which exists around us and is native to the soil must form the basis of a national style of ornament, if one is ever to arise.

The methods and manipulation in painting most desirable for the decorator should to a great extent be determined by the question of economy. Students of decorative art need to make the most of the limited time which they have for study. That their work may influence the greatest number it should be produced at the least possible expense consistent with the proper remuneration of the skill employed. A searching course of study that will make clear the vital principles of painting, in themselves of a comparatively simple nature, must be pursued. To the student who fully realises these principles the way lies open to the highest things. The most direct means of expression are those which should be sought. Stippling, scumbling and glazing may be looked upon as refinements for occasional use only by the finished painter. The desired effect should be sought

for with large brushes in one painting, that is, each portion of work should be completed before the paint employed has had time to dry. To accustom the decorator to the kind of manipulation which is most effective at a given distance, he should have practice in painting from objects by taking his standpoint of observation at a different distance from his easel for each subject. Thus he would learn to make every touch effective, and would in time know the sort of handling suitable for every distance, for that of a dado, a wall or a ceiling, and his work would become an exemplification of the truest economy, for not a touch would be thrown away.

Education, refinement, degree of ability, and to some extent capital, will decide the line of work for each student of art. Liberty has been the foundation of England's greatness. No one craves it more than the art-worker. It is useless to attempt to draw a rigid line between the picture painter, the sculptor and the decorator. The master decorators of Italy exchanged one class of work for another without hindrance, and the art workmanship they did not do themselves was executed by enthusiastic pupils and not by machines. What interest is served by preventing men from accomplishing that which is the natural outcome of their talents?

If, by reason of the improved education of those outside the faculty, art is regulated by knowledge instead of fashion, we may be sure that the decorator will not be allowed to err greatly, whether his efforts be confined to a branch of industry in which he is a skilful workman, or whether he be painter, sculptor and decorator combined. Whatever the scope of his work, may he be permitted to move with the elastic step of freedom among the busy scenes of to-day, chastened but unburdened by the traditions of the past.

The capacities of the young are a mine of wealth from which it is to our interest to extract the ore. There are hundreds of children in the elementary schools with great aptitude for art-work. Whilst we are still discussing the necessity of improving and extending art education, the

great majority of these possible art-workers are drifting away into all sorts of uncongenial employments. They are seldom those who pass brilliantly in the three R's, for the hard grain of the business man is not theirs. Are we to continue to allow these sensitive natures and fertile inventive faculties to be crushed in a conflict for which they are totally unfit, by the withholding from them of that opportunity which will surely lead to their true development, and to increase in the wealth and refinement of the country at large? Do for them that which has long been done for youths possessing unusual ability for literature or mathematics. By the foundation of scholarships let a road be opened from the elementary school up to and through the doors of our great national art institutions and we may yet see master decorators like Raphael and Michael Angelo arise in our native land.

DISCUSSION.

Mr. TUCKER said that he was concerned with the practical application of art as applied to the manufacture of carpet work, which application was necessarily very limited on account of the requirements of the manufacture. When he commenced his present duties a great difficulty arose, through a special jealousy which existed amongst the manufacturers lest the designs which they were constantly producing should be made public and borrowed by other people, so that those who introduced designs would lose the benefit of them after they had cost a large sum to produce. When he became master of the School of Art at Kidderminster, the manufacturers said to him, "We would rather that you did not train your young students to produce designs, but teach them to draw. That is the foundation of all we want." He therefore had to cast about in order to find out a means by which he could teach the students to draw, and carry them

a little higher without interfering with their trade difficulties. Those difficulties were many, because, in the first place, the operatives whom the manufacturers took to produce their designs were simply selected without any reference to their art powers. They were made designers, or rather copiers of designs first, and sent to learn to draw afterwards. He came to the conclusion that the first thing he ought to do was to make the operatives capable of drawing beautiful forms correctly. Perception of form, the construction of ornament, and the development of lines from one another tangentially, was the first necessity. He insisted upon it that every student should be able to produce a fair drawing of what was known in Schools of Art as the Tarsia. After he had obtained a certain amount of power in copying beautiful form, he was supplied with a brush and some ornament to copy, which he had to do in one colour. The next thing after that was that the students must have mechanical exactness in their work on account of the multiplication by machinery and the repetition of the forms. They had to take the outline, and lay a ground, and trace a form on it, and then fill it up with the colours required, so as to get power in laying flat tints. The next thing was that the student must go to nature. He happened to live in a district which was very highly favoured with the beauties of nature; and he made the students work from plant form to a very great extent. When summer came copies were put away, and leaves or portions of plants were put before the students to draw from in a certain time. That was the fourth step. After that, the students had to learn something about historic ornament in order to see what had been done before them, and to get some idea of the style and treatment of the different countries and ages. This included copying the forms from fabrics and putting them on the ruled paper which is used for carpet designs. Then the student had to copy natural flowers, leaves, and plants in distemper colour on tinted ground direct from nature. Next, he had forms to arrange without reference to the special

manufacture in certain spaces. Natural plant forms were taken so as to fill up agreeably in a grouped arrangement certain spaces which might be given him. Then he had to do the same thing in colour, adopting the colours suggested from nature, or modifying them to suit his particular requirement. After that, he took a design and worked it out in colour without reference to the ruled paper, so as to get his arrangement of form and colouring. Finally, the pupil translated the design to ruled paper so as to be ready for the mill. This was the course of design which he (Mr. Tucker) had mapped out for his own special district, but of course it was very limited on account of the difficulty of the manufacture and the mechanical exactness required in the multiplying of the forms by machinery. He found that a difficulty arose from the students coming in utterly untaught in drawing in any way; and some three years ago it occurred to him that it would be well if an arrangement was adopted somewhat similar to a suggestion made by Mr. Ablett to the Science and Art Department last year, which was that there should be some connection between the drawing taught in the elementary schools and the schools of art. Why should they not have the best materials they could for the designers, instead of the students being selected without any reference to their power? He himself offered two or three studentships for boys from each of the elementary schools in the town. He offered to give them two years' instruction in drawing in the School of Art, to bring them up to the time at which they were usually apprenticed. They had, he believed, seventeen students from the first competition, and nine of that number had gone into the designing rooms, and were now engaged in designing. The demand from the manufacturers for apprentices was very great, and he had constant application for similarly trained students, which he was sorry that he could not always supply.

Mr. H. STANNUS said that the three papers which had been read were full of thought and suggestive of discussion The paper by Mr. Ablett was an exceedingly interesting

one, well worthy of their consideration; but in the limited time, without having seen it, he could only touch upon one or two points, which he raised for discussion, and not as objecting to the general argument. Mr. Ablett asked, "May we not discard the use of broken or pointed lines, seeing that the drawing that we term 'writing' is executed with a continuous line?" What we termed drawing was made in bits, but there was this distinction between writing and drawing—that in writing the writer knew the character which he was going to make, and he did not look at anything else to copy it from, but he drew a continuous line: but this was not the method in which a drawing was produced. If, for instance, Mr. Ablett was going to draw his (Mr. Stannus's nose), he could not draw it in one line. He would have to keep looking up and down, and that very looking up and down would cut the line up into bits; and therefore the analogy between drawing and writing did not hold good when a person was drawing from a copy. Of course if a man were designing from his own head, he had not to look at a copy, and the action would be more like that of writing. Then Mr. Ablett had said that art teachers would soon have to justify their existence. He (Mr. Stannus) hoped that they would always have to justify their existence. They were not worthy of their position as art teachers if they could not do so, and if they had not justified their existence in the past. Mr. Ablett had said that knowledge was common to all mankind. That, however, was not strictly true. It was the opportunity of acquiring knowledge that was common to all mankind. They all had access to the libraries of the past; but nothing was knowledge to a man until he had absorbed it and amalgamated it into his own entity so that he could not think without it. If the knowledge were merely in a man's book-case, it was not knowledge to him, and thus knowledge was not common to all mankind, but only the opportunity of it. Mr. Horsfall had seemed to think that the English were behind the Venetians in colour, but he (Mr. Stannus) submitted that Venetian colour was only a

recipe or a trick which a man went to learn. Mr. Horsfall showed that fact when he said that the Venetian colour was better than that of the Florentine school. The Venetians had a collection of recipes for harmonising colours which were now termed "Venetian colour." Colour itself was infinite and endless, and the term "Venetian colour" did not cover the whole field. In the system of music we had recipes for chords. These recipes were simply so many short cuts to harmony. The men of the present day had, as it were, taken advantage of what somebody else had done before them, and they copied him; but the question of harmony was infinite, and, so far from it having been settled, every one who knew anything of the work of that great man Wagner, who had lately passed away, would know that harmony, instead of being a finality, had only taken a fresh departure. So it was with colour. Colour took a fresh departure every time the sun rose on the earth; and they would never be able to exhaust the wonderful infinite beauty which there was in it. Then Mr. Horsfall had spoken about the "abominable aniline colours." He (Mr. Stannus) granted that they were unmanageable now, but there was a time when every colour was unmanageable. It was so until a man arose who was able to be the master of colours, and who could make them harmonise. Every time that chemistry added another colour, that colour was a difficulty until it was brought into the grasp of the colourist and made to harmonise. He believed that the time would come when the "abominable aniline colours" would be brought under the mastership of some great colourist: all that was wanted was that some one should arise with power to use them, and then we should no longer find them objectionable. Mr. Brophy, in his paper, had spoken a great deal about the teaching of design, and he had exhibited some works in another part of the building, which were hung up as illustrating design. To set a thing before a student to copy was not teaching design. What they wanted to secure was that the students should *continue* to design after they had left the school; the teacher

having taught them some ideas as to principle, fitness, and proportion. In the examples to which he had referred, and which were copied with such careful fidelity and marvellous unanimity, he saw no evidence whatever of any feeling after proportion, or of what artists called "principles of design." If a system of teaching were worth anything, it must be taught on principle. All the systems in the world would never knock out the originality of a student. They would merely guide him in expressing his own ideas. A youth might have a new "Paradise Lost" in his brain, and yet come to a teacher to learn grammar. The teacher would instruct him in grammar, and then the youth could write his poem better than he would have done before he learnt the principles of grammar. The teaching of grammar would never knock out his originality of ideas: so the teaching of art principles and art training were merely the grammar of the subject, to enable a man when he had got an original idea to show it in a more polished manner than he would otherwise. But in those designs which were to be taken along with Mr. Brophy's paper, he (Mr. Stannus) failed to see examples of that principle. The paper itself was a most eloquent one, and he thoroughly agreed with a great deal of the good sentiments which were expressed in it; but he took it that they were there for business, and if possible to gather from a conference with each other something to take away with them. He quite agreed that it was a good thing in teaching the designing of a conventional ornament to put some of the work of the past before a student, and to say to him, "That is good in that particular, and it is bad in *that* particular. It is good in the massing and in the general curve, but it is bad because the designer having set to work to fill up the panel had failed to fill it up." Then the student might put in his own filling, but he could not call the result a design: it would be a mere adaptation. But he regarded it as a step in designing to put before a student an example, and show him its good and bad points: in that way the pupil was taught to think and

to make original designs for himself. Then, again, in designing from nature, they had adopted a plan at South Kensington by which, after a student had drawn from a natural flower he was required to make three designs working in the flower, or rather to make three treatments of the same design; one treatment being perhaps a border of inlaid wood, and the next treatment being the same design worked out as a pattern for embroidery. Then the student would show how he would further modify the design if it was intended for lace. The production of the same design with the three modifications compelled the student to consider carefully the technical alterations, for if he were allowed to make a different design in each technical process he would never be brought face to face with the difficulty of translating the same design into lace work, and into inlaid wood, and into embroidery, and into cast iron and wrought iron, and so on. The plan which he had described had worked very admirably at South Kensington. It had generated a concentration of thought on the technical difficulties, and this he hoped would have a good effect on the training of the masters and mistresses who were sent out by the Department. One of the great hindrances to the teaching of design was the pernicious system of giving medals. He said this with great diffidence in the presence of Mr. Sparkes, but the system was a most dreadful one. They all recollected Falstaff's advice to one of his followers: "Put money in thy pouch; honestly if thou canst, but still I say put money in thy pouch." Every poor master of a school who had got to depend upon results said, "Get medals in your schools;" and that system had generated a set of masters who, he hoped, were very few in number and were dying out. They had gone in for getting medals and medals only; and it was impossible to avoid that dishonest method of getting a set of students and encouraging them to take up their designs and get medals. Personally, although he had a great deal to do with designs, he felt that medals given for design were a great mistake. One

student who was under him last year got a silver medal, he was sorry to say, in the national competition. Medals did a deal of harm. He would sooner that they got the knowledge. This year the man got a gold medal, and he came gloating over to him (Mr. Stannus) and told him about it. He condoled with the receiver of the medal, and told him what a terrible calamity it was for him. When he (Mr. Stannus) first went to the department, knowing the difficulties that beset people, he said, "Am I to train people to get medals or to get knowledge?" Mr. Sparkes's answer was "Give them knowledge and never mind results." Until they could bring pressure to bear that no medals should be given for designs, he thought that it was almost hopeless to teach principles, except perhaps for the sake of such comfort as every man felt when he had done his work well. Mr. Sparkes in his interesting paper alluded to a system which was commenced at South Kensington before his (Mr. Stannus's) time, but which was still followed. It consisted of taking the students into the museum and setting before them a certain model, showing them the strong points and the weak points, and the things to avoid, and the things to imitate, and then two or three days after giving them a study having reference to it. This, as Mr. Sparkes had said, led them to observe and to carry their observations into practice. Some people had asked why men engaged in designing for different sorts of manufacture were not kept each to designs suitable for his own trade. The training suitable to one particular trade was a deep and narrow rut or groove, and the students came to South Kensington to have their knowledge widened. One of our Authors had said that a man should know something of everything and everything of something. Of course, it was hoped that these students would know everything of the one thing in the groove of art in which their future life would lie; but they would be none the worse workers in that groove if they should during their two years' sojourn at South Kensington have an opportunity of looking over the walls into the next field and seeing the kind of flowers

that were growing there, and so broaden their observation and their culture.

Mr. CHARLES BIRD (Mathematical School, Rochester) said that, as the head of one of the schools of the modern type, he, and he was sure many others similarly circumstanced, would highly appreciate the efforts which Mr. Ablett was making in the direction of the teaching of elementary drawing. Until quite lately art had been taught in most of the schools by a visiting master who came once a week, and set the boys or girls to produce the drawing of a bridge or of a donkey, or something of that kind. One of his own little girls during last term completed a donkey in thirteen lessons, and brought it home very beautifully mounted. Now that art was becoming a matter of class instruction, it was necessary to systematise the art instruction to a greater extent than had been the case before; and he must say that he hailed any of the little devices for interesting children, whether boys or girls, in their work. Under the old system of teaching, either of art or anything else, the clever children probably had an opportunity of getting on if they had a competent instructor, but the great bulk of the children were neglected. Teachers were now beginning to appreciate the necessity of infusing a great deal more interest into the work of schools. In his school, for example, they began drawing by putting a ruler and a pencil into the hands of the little boys of the first form, and telling them to draw a line three inches long, and then to erect a perpendicular line at the end of it two inches long, and then to put a cross-piece on the top four inches long. In that way the children got into the habit of using their mathematical instruments from the beginning, and taking an interest in their work, and seeing to what it led. They then allowed the pupils to colour any little design which they made. A boy could soon make a square and join the opposite corners, and so divide the square into four triangles; and then, if he had any aptitude for colour at all, he was allowed to colour in the divisions. And in this way they began a course of geo-

metrical design with little boys of seven or eight years of age. They had done this for two years with very satisfactory results. Although this method did not exactly fit into the South Kensington course, the examinations of which they were very glad to make use of, yet they found that, by diverging from the regular routine of the ordinary method of teaching drawing, they were able to secure better results as far as the examinations went, although they were not aiming at getting their boys through the examinations. He quite agreed with what had been said as to the effect of examinations and medals and things of that kind, and he thought that their school work would be better in every respect when they could dispense with such things. But the result was certainly that the boys took a great deal more interest in their work. In the second form they got to triangles and pentagons, and so on, and they gradually worked up to a moderately advanced course of geometrical drawing and designing. In connection with freehand, it was found that a great deal of interest was imparted to the work if the boys were allowed to colour in their drawings. Another very important matter in connection with drawing was the making of it a class subject. It was impossible in a large school, especially in the country, to attempt to classify the boys into groups according to their abilities as draughtsmen. At any rate he felt sure that it was impossible in a provincial day-school, and the temptation was, when that was not the case, for the teacher of drawing to let the pupils go plodding on, and to circulate round the class, giving each boy about a minute's individual instruction. He thought that it was most important that the teaching of drawing should be carried on in the same way as the teaching of geography and other subjects. That is to say, the object to be drawn should be demonstrated on a black board by the teacher in front of the class, and the whole class should, as far as ever it was possible, be kept to the same object. In that way, and by the various little devices of Mr. Ablett and others, a very great deal of interest could be imparted to the teaching of drawing.

The idea of using a brush for the simple designs was quite new to him, and although he did not take an active part in the teaching of drawing himself, yet he hoped to see the brush introduced into his own school during the next term.

The Rev. G. WEST said that he had taken a great deal of interest in the question of teaching drawing, especially to young boys under fourteen, for he began life as an architect, though he afterwards took to school-mastering. When he first tried to teach boys he could learn very little in England. He learnt most from the Belgian and the French schools. There was a great deal to be got from the Belgian schools. They there taught the pupils by means of black boards. They could rub out easily on black boards, and they did not get the horrid mess which was made by charcoal. He found the black-board method very useful, and it helped class teaching. The younger boys could draw on the black board, while the older boys were drawing the same things with charcoal or pencil. With regard to models and copies, those which he found best were those upstairs in the exhibition of the Christian Brothers. They were large lithographs with corresponding flat casts. It was very useful for the teacher to draw the thing himself on the black board, and make the boys copy it from the lithograph, or to look at the lithograph and then draw from the plaster cast. Then colour could be introduced to give the boys interest, and it also helped to start the boys in shading with perfectly flat tints, making the background one shading, and putting in very simple tints. With regard to the question of outline drawing and brush-teaching, he had been discussing that very subject with a painter a week ago. They were sitting out in the garden, and the painter said, "Look at that trunk lying there. It is a patch of brown against a patch of green." It was quite true, but how was a child to draw it except by an outline. Surely form perception must precede colour perception. In the teaching of shading, the system of shading by cross hatching, or any similar process which

did not make a mess, took time; and, if the pupils began to use a stump, in nine cases out of ten they got a smudge. He should like to know how to combine the outline-drawing of form which must be taught to children with simultaneous colour or shade-drawing of the same form. The painter to whom he had referred pointed to one of the regular South Kensington models of a vine-leaf which was hanging upon the wall, and he said, "I should teach a pupil to draw that leaf simply in colour." That was the very leaf which he (Mr. West) had tried to make the pupils draw with the stump, but it was far too difficult. If they started by using a brush, and worked towards the form by colour, and afterwards wanted to draw a vase, how were they to make the transition? He did not see how a teacher could get over that difficulty. They must learn to draw a vase or a chair, or any common object; but how could they combine lessons in the outline drawing of such objects with the brush-method, remembering that the majority were not going to be artists? He did not see where they could make the transition from one method to the other. He only hoped that somebody might give some hints as to how the brush-method might be worked in with the learning of that knowledge of form which was really the aim of drawing in the case of boys who were not going to be artists. In making drawing interesting the teachers would have a difficulty. A few boys would draw to a great extent for their own amusement, but they would not settle down to do anything exactly. They must, however, be made exact; and how were they to combine the seeing of things correctly with the drawing of things out of their own head? Only a few days ago there had been in his school a gymnasium examination. One of the boys who was very clever at drawing, made a set of skits on the examination, in which he represented cats doing the same things that the boys had done; they looked spirited and clever, but were totally inexact and careless in drawing. The cats were something like cats, but the boy did not learn anything from what he had done. He would not

do anything correctly or with the least care. In the case of such children, how was brush-work to be done, combined with lessons in form?

Mr. E. COOKE said: My remarks apply to one or two points in Mr. Ablett's suggestive paper. The complaint which he endorses, that under the present system the majority of students lose their zeal and gain little or no pictorial power, was not first made here. In view of it, he asks very pertinently, "Is our system adapted to the nature of the pupils?" He shows that in some ways it is not, and suggests modification, and his reason for the change is that the system does not agree with the natural, spontaneous method of the child. "Had teachers been guided by nature's hints they would have done better," he quotes with evident approval, and I cordially agree, but I wish to try and show that we cannot stop just where he does, if we accept the principle of nature teaching. It means not only reversal, but revolution. The method by which the child teaches itself and the method of the systematic teacher are different apparently. What the child's own natural method is we must learn first from children, then we must be willing to adopt their method if we would teach them. Of Pestalozzi it is said, "It was because he became the pupil of his pupils that he was enabled to stand up as a teacher of teachers." In this matter what does our observation of the child teach us? One of the unmistakably strong "hints" is that the child loves colour. But the teacher says you must go through a long study of light and shade before you attempt it. The child delights to use drawing as a means of expression; delights to draw from memory or imagination; and enjoys the invention of new combinations of known forms. The teacher treats all this with contempt, gives a long series of ornamental outline, and holds out the hope, perhaps, that in the far future, when the copy can be faultlessly executed, design shall be attempted again. The child's power of analysis stops at whole things; these he separates often carefully from each other; so far he can analyse, but he does not

break up his outline into parts, he draws the line at once as Mr. Ablett states. The teacher requires him to generalise and to block out his outline. The child, for subject matter, enjoys the most difficult things—figures, animals, and these too are liked best in motion—men fighting, horses galloping, birds flying, and ships sailing. The teacher laughs at and ignores its archaic attempts ; of course, they are impossible and useless. Draw this straight line horizontally and vertically, accept the monotonous and the uninteresting till you can do it well, or balance carefully these simple curves, without change or relief. Again, children do not think of measuring as a separate process, but they do draw in outline, and that very decidedly, though Mr. Ablett says they do not care for outline. That they do so constantly, has some bearing on the question of Mr. West. As the child's natural means of expression, we may take it that for them at least it is right. Professor Ruskin dwelt on this question of outline in his 'Elements,' and when I was in his class nearly thirty years ago, we aimed at the drawing of shade and neglected outline. Professor Ruskin changed his views later, and after about ten years' teaching experience I accepted outline, for I saw all students used it naturally, and later observation of young children, with whom it is universal, leaves no doubt that for them it should be used, and is right. I might make other observations on the difference which exists between the methods of the systematic teacher and that of the child, I add this only. The child wants to express itself, but the teacher limits its exercise to perfecting the means of expression. These are some of "nature's hints," coming with the same authority and from the same source as those Mr. Ablett has adopted. If they are natural it is vain to oppose, or if we do, we must expect failure. We had better in these days of science observe the child's nature and method, and adapt ours to it. For if we do not use and develop these powers when we can, when we want them they will be gone, or to be regained only by difficulty and conscious effort. At about the age of seven or eight

years a change takes place in the child's development, and this wish and power becomes modified or in abeyance. Yesterday, here, Professor Armstrong, speaking of the natural curiosity of children, pointed out the fact—with which I am familiar, as a teacher of natural science, and corroborate it—that unless the natural observation of the child is used by the teacher early, it becomes stunted, dull, or dies away. In Section A, directly after this, during the discussion on the early training of children in the Kindergarten, Mr. R. Hamilton stated that Dr. Routledge had said that in his practice he had never met with a case of colour blindness where the children had received suitable instruction in the infant school. And here is a third case of precious powers which, if left unused by the teacher when they are in full vigour, become arrested and pass away. This seems to me a matter worthy of the teacher's consideration. It would be possible to suggest exercises for all these hints obtained from child nature, but we shall have to reform and reverse our methods. Colour especially, I think, should be given from the very first. In looking through the work in this Exhibition, I am surprised at the scant use of colour in children's work. Mr. Ablett rightly, I think, gives it very soon. Could not the children in Board Schools have the pleasure of painting bright flowers sometimes, as well as those lower tones used in his copies? For more variety in teaching, Mr. Ablett asks wisely. It is often said to me, "Then you would give up systematic for nature teaching." I think if we consider the child's nature we shall find it needs varied exercise; and if we recall the way in which it acquires another means of expression, we shall see the place assigned to systematic teaching. The mother tongue is acquired first naturally; after the child can talk, it learns systematically to read, and later still comes grammar. It learns to sing a tune some time before the systematic teaching of music is attempted. So far am I from objecting to systematic teaching, that I complain it is not systematic enough. It neglects to include simple elements and necessary pro-

cesses. In every drawing, for example, at the instant of execution, the pupil is not looking at the object at all, but at his pencil. From what is he then drawing? From the memory of the object represented in his imagination. Yet who thinks of specially training these? Mr. Ablett does train memory, but the imagination, the necessary factor in every process, is not only neglected, but contemned. Again, the memory of the object being drawn, is modified by preconceived notions. And the fact to which I refer now is a most remarkable one. We do not in these western countries acknowledge fully all the simple elementary forms which exist, or if we do, we do not give them equal value. Square, and triangle, and circle we know; straight line and arc we acknowledge; these are our elementary lines. Ancient Greek and modern Japanese not only know, but are familiar with others, and by far the most beautiful ones. How does this strange neglect influence our drawing? Ask a class of girls of about fifteen, in a high school or an elementary one, to draw a cherry from the object. In many cases, although they know it is called a "black heart" cherry, the result of the first effort will be, in by far the majority of cases, a circle, or something intended for it. Why? The children have no other general notion of a simple elementary curved form; little or no elementary geometry is taught, but a circle they know; any knowledge of oval or ellipse is rare. Neither we nor our Continental neighbours recognise the full elementary value of these forms. We need oval and ellipse—not the elliptical figure struck by compass from four centres—and we need the elementary lines of which they are composed to add to the arc, and then there may be formed what has, I think, never yet been formed, or if so, it has never received its full value and recognition—an alphabet or gamut of simple linear form. And every stroke of the child may not only record one observation, as Mr. Ablett says, or the sum of its observation in its early stage, but in the later and systematic stage it will record an easily-remembered element, just as a word is formed of letters. It is a question also if

we vary the exercises for the hand sufficiently. Our so-called freehand drawing has been quite accurately described, and as a complete and sufficient exercise condemned, by Mr. Ablett, who advocates the constant use of that most important instrument—the insufficiently-used brush. Too much cannot be said for it ; it is the best. But there are other means. On Saturday last I took some friends and fellow-teachers to the Belgian Court to see the excellent black-boards exhibited there, and a good illustration of their use was presented there and then. An attendant, with evident enjoyment, was producing beautiful freehand curves on the floor, crossing and interlacing with a very unlikely and clumsy instrument—a watering-pot. He was swinging it freely from the shoulder, guiding the power gently and with a medium which presented no resistance. Thus good curvature was easy. A similar result might be had nearly as easily with chalk on those large firm black-boards, if we used a real freehand instead of cramped finger exercises, and added to it would be the pleasure of production, not the pain of the "grind." I have used for some time a black strained canvass fixed temporarily into the ordinary school desk for this purpose, and the most difficult curves become enjoyed, as the chalk slides rapidly over the surface with all the pleasure of a scribble, but with all the disciplined check of a controlled force. Children delight in scribbling ; we scold where we should carefully govern. The very first drawings of little children are for some time only incoherent scribbles, yet they like it ; the muscular action itself is pleasant. It is this same natural activity pressed into service and disciplined which enabled the Greeks with pleasure to draw as Mr. Ablett has done the so-called honeysuckle ornament. It is a force of great value when so controlled. There is another delight of children, specially valuable in decoration. They enjoy repetition ; and that too for many purposes the teacher needs. If a child follows its bent and draws animals its own way, in action, and repeats them, outlines them, and colours them too, he will produce a drawing which may be

comparable to the archaic period of more than one historic school, probably something like these drawings copied and enlarged by a boy from the First Vase Room in the British Museum. And this suggests to me another means the teacher has of obtaining, not only hints from nature, but of verifying the observations made of the natural methods of the child, and of seeing where they lead and how they may by gentle guidance be developed. Pestalozzi pointed out before it had received the sanction and support of modern science, that there was a similarity, a parallelism in development between the individual and the race. The Greeks gradually attained perfection by accepting hints from nature, and strangely do their archaic work and that of the child agree. They, too, worked in outline and colour, loved men and animals in motion, drew from memory and imagination, delighted in the disciplined scribble, the real freehand work, and out of this delight in expression and in handling arises their great technical skill. "First make your artist, and let him direct your decoration," Ruskin said long ago when the subject of Schools of Design reform was under consideration. That question reminds me of a strange fact. There exists a system of drawing in this country in which the delight of invention is one of the chief elements. It is intended for children, and they enjoy it. Yet our educational authorities neglect the Kindergarten system, which trains early the inventive powers natural to children. One other observation only. "If," Mr. Ablett says, "a system of teaching elementary drawing can be established which shall keep up and develop zealous practice in pictorial expression, it will be worthy of support on that account alone, for it will have succeeded where our present system has hitherto failed." For variety in teaching, as it uses, and therefore exercises, the imagination, it should enter into a systematic training. I have for years attempted this practice. Children enjoy it; for it they take trouble on themselves willingly and happily, they investigate and assimilate before they can use; they teach themselves, and no one else can teach them so much.

They give themselves that discipline, and make the effort which, if imposed, and without the interest, would make their work a "grind." Their whole nature is involved, and is on the side of the teacher, will and emotion, as well as sense and intellect, and without this full and free work there is fair probability of failure and loss of interest.

(Some original coloured drawings by four children in one family, the eldest thirteen years of age, the youngest six or seven, were shown, done immediately before the Conference illustrating Andersen's 'Story of the Eleven Brothers.')

FRAULEIN HEERWART (British and Foreign School Society), on being invited to join in the discussion, said that it was an honour to her to be asked to say a few words. She was a Kindergarten teacher, and not a teacher of drawing, but she was much interested in the subject of drawing and painting. She looked almost with envy at the opportunities which young ladies had when they went to South Kensington. At one time she worked in the School of Art, and found much pleasure in doing so, but she was almost startled when she was asked to appear at the annual assembly and receive prizes. She had been working in the school merely for pleasure, and not for reward. The method adopted in the Kindergarten was that the children should handle things in as concrete a form as possible, that the forms might be impressed upon their minds; for it was believed that if they had a clear picture in their minds when practising with the hand it was possible for them to reproduce accurate forms. And for that reason the Kindergarten children had ample opportunity of not only looking at the actual forms of geometry, but of inventing and expressing anything that was in their minds. Especially it was always to be desired that they should have the forms of nature in the shape of leaves and flowers and animals. The eye ought to take in the form accurately, and for this reason they ought always to prefer the beautiful outlines of nature, and impress them on the mind of the child. In the building in which they were then met there was an exhibition of Kindergarten

work, materials, and designs. She would be glad if any of the gentlemen who taught advanced drawing would take the trouble to look at the simple attempts of the little children, and the actual means which were employed in the Kindergarten.

Mrs. WESTLAKE (London School Board) said that, having mourned for years over the waste of opportunities, and the miserable instruction given in the primary schools, she was thankful that a new era was dawning upon them, and that better methods were being introduced. She believed that the children in primary schools, if they were well taught, would be deeply interested in drawing, but, owing to the so-called system of free-hand drawing now in vogue, there was a failure to arouse their interest. The so-called free-hand was anything but free in the niggling work which the children had to perform. They cared no more about the drawing lesson than about any other lesson. She thought that they must look to South Kensington to give them some better method, and she knew that it was the opinion of Mr. Sparkes that they could only improve the methods by getting a better means of examination. They must look to the teachers to teach drawing in a better way than at present. A large number of teachers in the elementary schools, and especially board-schools, had what was called a D, and with that D they were supposed to be equipped with all the means of imparting their art. This D was the most miserable production possible. She had often questioned the teachers who had obtained the certificate, and she had found that they could not draw the slightest object from nature. It was only by training the teachers to better methods that we should improve the teaching in our schools, and improve the drawing of the children. The London School Board had started a school of art of their own, in which the teachers were to be trained in better ways, which it was hoped they would impart to their scholars. They had already seen the good result of this improved teaching in the results of the schools, but they must appeal to South

Kensington for help in the matter, and, if necessary, to give their grants upon an altogether different system. With regard to the lost opportunities of the children, it would be seen that much help could be given to prepare the pupils for the work on which they would enter in after-life. A large part of them became artisans, and they ought to acquire in the schools the free use of their hands in drawing, which was the basis of most of our trades; and we ought to introduce into our schools the methods which had been so successful on the Continent, as, for instance, in Belgium. In that country the whole of the technical teaching was drawing in its widest sense. It was not confined to one particular branch, but there was the free use of the hand in drawing every possible form. A great help to this teaching was the lining of the school walls with black-boards, which the children themselves could use on all occasions. She hoped that the apparatus in English schools might be so improved that a lining of black-boards might be introduced for the same purpose. She felt that it was only by constantly training the hands of the children on a large scale, and by daily work, that they could give them that freedom in the use of the pencil and the brush which was necessary for them in their technical work.

On the motion of Mr. WEALE, it was resolved to resume the discussion at an afternoon sitting.

The Section then adjourned for a short time.

On resuming, Mr. MAGNUS again occupied the chair.

Mr. WEALE, in continuing the debate, said that in the admirable papers that had been read that morning, though there were several points with which he wholly disagreed, there were two with which he sympathised. One was the remark of Mr. Ablett that the rise of a national style in ornament was one of the things most to be wished for; and the other was the statement made

by Mr. Sparkes that architecture was the basis of all design. In the past there had been two periods in which art was really national and logical. One was the period of the art of Greece, which was unsurpassed in pre-Christian times, and the other period was the Middle Ages. The development of the art of the Middle Ages was arrested by the Renaissance. Mediæval architecture was often said to be dead. How could it be revived? To his mind, if architecture was not living there was really an end of all life in ornamental designs, and we should only be copying, more or less. As to the system of teaching ornamental design, this was his idea. In a country which was not very far away from our own, namely, Flanders, there existed a people which had a certain relationship to the English people. In that country the manners and the language of the people, in olden times, bore a very great similarity to our own. That country had been very unfortunate in one respect, and that was that, ever since the fourteenth century, it had been dominated by foreigners—the House of Burgundy, the Spaniards, and the Austrians, all of whom had set their heel down upon the people, and more or less proscribed their language. This was done to such an extent that even twenty years ago it was forbidden to children in the schools to speak their own maternal language. The consequence was that the Flemish language as a literature had almost died out. A few years ago an attempt was made to revive it, and there were different schemes for that purpose. Some people thought that they ought to turn to Dutch as being the most common, and the Government started a commission to regulate the Flemish language. But, on the other hand, a certain number who had read and studied the old Flemish literature of the thirteenth and fourteenth centuries took to writing in the West Flemish dialect, and they had gradually re-awakened the national sentiment. And now the West Flemish language bade fair to become, in course of time, the language of all Flanders. He believed that, in the same way, in teaching art we must take, as the basis of education, the style which

appealed to the nation. He did not believe that an eclectic system of art education would ever impart to pupils the faculty of creation. What we really wanted was to make the designer original. His designs, no matter for what branch of art or manufacture, should be the outcome of his thought, just in the same way as the composition of a musician, or a poet, or a prose writer was the outcome of his thought. He believed that there was nothing that tended more to hinder the growth of the faculty of creation than a system based upon eclecticism. He had been associated for some years with a movement which had sprung up in Belgium. He was perfectly convinced that the school with which he was associated, not at all in the way of teaching, but rather in encouraging it and helping to raise funds for it, would, in a short time, beat all other Belgian schools. It was the school of St. Luke, at Ghent. This was an exclusively national and mediæval school. Its founders were convinced that mediæval art was that which appealed to the people of Flanders ; and, although he granted that the Flemish style was not the highest development of mediæval architecture, yet there was something in it which responded to the sentiment of the people of the country, besides which it was adapted to the materials at command, such as brick and blue stone. What he had noticed about that school was that it had brought about in the pupils a love of work, and also a great deal of originality. It was found that they went to nature, and that they conventionalised ornament from it pretty freely. The school had been conducted without Government help, but in a most economical way. Although 450 boys were being taught gratuitously, the whole cost of the school did not exceed £250 a year. The education was given to apprentices, to workmen, and to peasants, who sometimes came from long distances. The work of the school, which comprised a course of seven years, might be seen in the Belgian Section of the Exhibition. With regard to popular education, a process of decadence arose from the centralisation movement which took place at the time of the establishment of

the Universities, and led to the abandonment of the local schools. So was it also with art. Art ceased to live. Artists left off working for the people, and they worked for the sovereign, for the upper classes, and for the dilettante. He felt certain that whatever might be the opinion of the dilettante, there was in mediæval architecture something which appealed to the ways of the people in Northern Europe in a manner which no other architecture did. Art was quite inseparable from national life. The slightest original effort of national life was stopped by the Renaissance, and the question was how to revive it. It was by attempting to graft classic on to mediæval forms, and to mix styles, that art had been brought down to a state of anarchy. Without the unity of principle, and the condition of logical development of art-thought, he did not think that art could become a fruitful organism in the national life. The whole system of education in our art schools ought to be made more thoroughly national and less eclectic if we wished to revive originality in the work of our artizans.

Mr. CLOUGH said that the discussion which had arisen out of the three interesting papers which had been read rendered it evident that something might be said in favour of the principles expounded by the readers. As to the question of the early employment of colour, that practice had been one of the chief causes of his own success as an art master during the last ten years. He had had some experience of the teaching of what were commonly called young ladies' schools, in connection with the school of art of which he was master; and he found when he went into those schools that the pupils were working with the usual sort of rubbish, which was of no use either to man or beast. After some little time he succeeded by means of coaxing and diplomacy to get them to work on design in color. He used distemper and not water colour, as young students failed to obtain anything like a flat result with water colour. He made a drawing on the blackboard, and this the students had to

copy. Children of seven or eight years of age worked with two or three tints. He had often been surprised at the facility with which children executed work of this kind. Another advantage of this method was that the younger children were being taught the principles of composition, and consequently of observation. He found it most important to interest the children. It was of no use unless the master could keep "well on" with the children. One teacher had referred to the difficulty of teaching children to draw from solid objects. His method, and one with which he had every reason to be satisfied, was to give an alternate lesson when the students attained the age of eleven years. The children had only one hour a week. He was speaking of those who were so mercilessly condemned in the discussion that morning. The alternate lessons consisted of design and model drawing, each being a class subject. He had a group of models on the platform, and the student tried to draw them. He himself drew the models on the blackboard, line for line. He carefully laid down the horizontal line, and he found the vanishing points in a very simple way, without explaining to the children, and in a short time they could draw objects in a much more easy and accurate manner than by the ordinary rule of thumb teaching. All members of the Conference would understand how work like this must necessarily facilitate the studies which came after. One speaker spoke of the difficulty he had with a boy who would draw cats. To his (Mr. Clough's) mind it was a virtue to try to draw cats. He wished that he had more boys who would draw cats, at eight or nine years of age. There was material in such a boy, and it only wanted to be used aright. He felt somewhat indignant when he heard persons say that they had difficulty with clever boys. His own difficulty was with the dull ones. In the national schools the one difficulty had been the confusion of lines in freehand and outline drawing. He could not go all the way with Mr. Ablett, but in the main he agreed with him. Mr. Brophy had treated the subject in such a wide manner

that it became difficult to say anything about his paper, but he could not help thinking that Mr. Brophy attached too much importance to getting all one's inspirations from nature.

Mons. COUVREUR explained to the Congress the various measures adopted in Belgium to develop the artistic education of the people. He said :—After lengthy discussions in educational conferences and councils, the Belgian Government acknowledged the necessity of introducing the teaching of drawing in all elementary schools, not as an accomplishment, but as a compulsory subject, quite as important as reading and writing. Drawing, like the spoken and written language, is a means of expressing and communicating thoughts. In many cases it is a more rapid and clear process. Drawing was the original form of writing. It should be restored to its former position, and this can only be accomplished by the schools, and in the schools by the teachers. But the teachers had to be trained. As time was pressing, as soon as the best method to be introduced in the schools for teaching drawing had been decided upon, the Minister of Public Instruction established training lessons. The students who attended them received their diplomas after undergoing certain examinations, and, in their turn, they now impart the knowledge they have acquired to the students of the training schools who are to become teachers. Inspectors belonging to the academical bodies are entrusted with the supervision of the application of the new methods. These methods, and the results they have given, are being exhibited in the Belgian section. They reject absolutely the practice of drawing from prints, which is still partly carried on in France, and in private schools, and in the schools of the Christian Brothers in Belgium. As soon as a child is able to draw lines, and his eye is accustomed to measure distances, he is set to reproduce geometrical forms, plane surfaces, and, later on, solid bodies. Such is the manner in which elementary geometry is to be taught in our primary schools, even in girls' schools. The cutting

of a dress or a garment is a geometrical operation, and for this reason projection is taught to the children as well as perspective. This can be ascertained by an examination of the copybooks (coming from village schools) exhibited in the Belgian section by the Ministry of Public Instruction. To train the children's hand in their earliest youth, the sygmographic system, used in Austria, has been adopted, not to mention other processes which are connected with the reforms introduced in our primary educational system since 1879. One of the characteristic features of these reforms is to develop the children's faculties and their manual skill. But the Government has not only introduced the teaching of drawing in all our schools; it has also wished to teach children how to paint, not to make artists of them. but to develop their taste, and make of them skilful artisans. Belgians, and particularly Flemings, have a natural sense of colour strongly developed. This natural gift has to be cultivated, and this duty devolves upon the schools. But how is the use of colours by children of from seven to ten to be introduced into elementary schools? As it is, parents complain that ink soils the children's clothes. It would be much worse were the children to handle boxes of colours. This difficulty has caused the idea to be momentarily abandoned, and we must be satisfied with the results given by the Kindergarten method applied even in primary classes. This method, as is well known, consists in placing in the hands of children, of the ages of from three to seven, pieces of paper, wool, and wood, of all colours, and in getting them to form with these materials objects of common use. They thus learn, whilst playing, the names of colours, their shades, their harmonies, and their contrasts. Their taste is developed, and their aptitudes are thus discovered at the earliest age. Whilst the children are getting familiar with the various colours, they are taught their relative tones by means of drawings, executed sometimes in chalk on the black board, sometimes in pencil on white paper. Starting with white and black, the children are taught all the intermediate

shades, which they reproduce with a brush and Indian ink. This ink is not more inconvenient than ordinary ink, and the parents do not object to it as strongly as they do to colours. But what we can not do in the elementary school we can do in the training schools or in the technical schools, and there the students are taught to colour the different forms according to their own choice. Drawings are given them to colour, and explanations of the harmonies and combinations of colour are given by the master. The system is quite new, having been introduced only a few years ago, so that we are not able to say yet what will be the result; but my opinion is that it will contribute to raise to a very high level the taste of the working people and the value of labour. I may add that the examples which are chosen by the master to illustrate his teaching are selected in such a way that they may have a practical bearing upon the future occupations of the learners.

Mr. T. C. HORSFALL, speaking on the subject of Mr. Ablett's paper, said that he wanted to speak especially with regard to a practical way of acting on the conviction, the soundness of which had received such important confirmation by what Mons. Couvreur had just stated, that it was in the earliest years of life that the sense of colour must be developed. In Manchester they had felt that they must get the help of some of the very best colourists in the country, and they had appealed to Mr. Morris, who had kindly given them the greatest possible help. They had formed a very carefully selected collection of beautiful coloured fabrics, and they had especially chosen those which it was likely that girls of the working class would be able to use for their own garments. They were framing the specimens and placing them in the elementary schools, and hoped to arrange that ladies and gentlemen who had given a good deal of attention to colour should go to the schools and talk to the children for a very few minutes about the beauty and combinations of the colours shown in the fabrics. In that way they would not only

bring some beautiful things before the notice of the children, but secure the other condition, without which the mere seeing of beautiful things was of almost no avail, for they would get the weight of the authority of persons for whose opinion the children had some regard. He believed that one of the best results would be that those of the masters and mistresses who had some power of learning to care for good colour, and to see the difference between right and wrong colour, would imitate the example set by the visitors, and that thus the influence of authority would be constantly brought to bear upon the children.

Mr. R. H. A. WILLIS (Manchester) said that he thought that the two papers which had been read, together with the remarks which had been made during the discussion, dealt very ably with the subject. Mr. Sparkes's paper dealt very fully with the Science and Art Department curriculum. Mr. Ablett in his paper was, he thought, right only to a limited extent. The lower diagram which he had exhibited, representing the letter *s*, was a gross exaggeration of the general character of the work produced by pupils and teachers such as had been described by Mrs. Westlake; but whether a teacher who produced such work should be described as an art teacher, or a teacher at all, was rather questionable. During a considerable experience of teaching, he (Mr. Willis) had always found that the greatest difficulty was with those students who had been taught before. The Government laid down that twelve years was the lowest age at which students should be admitted to schools of art. The Government thought that younger students would rather hinder the work of the school, but he found that students coming from schools where they had picked up a knowledge of drawing were much more difficult to train than those who had had no previous teaching. Mr. Ablett's illustration of the class of drawing produced by such students, if students they could be called, was a miserable one. The teachers were timid, and the pupils themselves were timid, and the result was what Mr. Ablett had pictured. He did not believe that half a dozen

teachers out of five hundred who had been trained at South Kensington, would permit such a thing as the drawing in question to go through their hands. But, owing to the immense number of children and the small number of teachers, it was very difficult, unless the discipline was very exact and thorough indeed, to superintend all the work done in the school. Mr. Brophy had made some very good observations, in which he laid great stress on the importance of early education. The students when they came to a school of art should be handed over to a man who was not merely just qualified, but who was thoroughly qualified, and knew well what the ultimate end and aim of a student's work should be. The men who now undertook elementary teaching, were men who had just got over the limit which the department set, which was too low a limit, because we could not get people to devote their time and their lives to qualify themselves highly for positions which were very much under-paid. He was thoroughly sincere in all that he said upon this point. The elementary class at the Manchester school was taught perhaps by one of the best designers that had ever left South Kensington; and, to secure that the final end and aim of the student-period should be kept in view, he made it an additional condition that not only the age, and all the other requirements that were usually put upon the upper right hand label prescribed by the Department, should be entered, but other particulars, in order to show whether the student was simply studying as a matter of general education or pleasure, or was studying with a definite aim in view. When students were studying for general education, they were put through a thoroughly sound course, because the knowledge of drawing would be of service to them, no matter to what they might ultimately turn their attention, and at least the teachers would have the satisfaction of knowing that the students were not throwing their time away. In the case of a student who came with a definite aim in view, the teacher gave him such direction in his work as would be likely to benefit

him in his trade. The student was not in the hands of an ordinary "drawing" master, but he was in the hands of a practical man who was training him up for his work in life. In the elementary class of the school with which he was connected they had extremely large diagrams made. They were large enough for the whole class to see, and they were taken from actual objects. Those objects were brought into the room, and the teacher gave a little history of them. The students thoroughly understood what they were doing, and the lecture was made a useful one to those who had a practical end in view. He was of Mr. Brophy's opinion—that there was no section of the school-work so important as the elementary, because, when once they had the power of hand and accuracy of eye, they might be put anywhere, and they would find their own level. When the children were taught to be thoughtful at the beginning, the after-training would be more easy. Mr. Stannus had made a statement that day which showed that he was not quite conversant with the regulations of the Department. He said that he hoped to see payments on national competition awards abolished.

Mr. STANNUS: I beg your pardon, I said *medals*.

Mr. WILLIS said that Mr. Stannus stated that the payments were dependent upon the medals. He (Mr. Willis) begged to say that they were nothing of the kind. The payments by results were made on the results of the general educational work of the school, apart from the prize work altogether, which was not paid for. He thought that no step would be more fatal to the interests of the schools than to withdraw the payments, although personally he did not care a snap about them. There were, however, many small schools in certain localities which could not be supported by the neighbourhood, and he did not see that any better way could be devised than a payment by results, particularly as the department did not pay the masters for coaching the students up to a very high standard. As to the gold medals, he supposed that they could not be taken as a fair criterion of the work of the

school. Undoubtedly, where there was a large number of highly-trained classes the chances were ten to one that the best students would take high rewards; but he did not think that a high reward was a criterion of the effect of a school. One speaker made a very pertinent enquiry as to where the definition of form by a single sweep of the brush was to end. He (Mr. Willis) answered that it was to end where the scale of small ornamental forms became too large. Scale had something to do with the definition of it. But there was another thing that must define the limit, and that was where the higher forms of great variety within the outline were introduced, as in the human form. He now began to trench upon a subject as to which the landscape painter had rather perplexed the speaker just referred to. It was all very well for landscape painters and others to talk about this matter in a general way, and to tell people that there was no such thing as an outline. Strictly speaking, there was not. What we termed an outline was an altogether conventional thing. John Collier defined an outline very well, and it was the painter's outline which he spoke of. It was the line of demarkation of one form against another. If he held his hand against a dark object behind it, and a representation was going to be made of it, the artist must decide whether he was going to draw the inner edge of the background or the outer edge of the form which was to be defined. He (Mr. Willis) should say that if there was a dark object on a light ground they would perhaps draw in the dark object. The thickness of the line went for nothing. It was part of the colour of the body of the object that was being drawn. Or if they regarded the inner line of the background as the correct one to be drawn, then the thickness of the line would be a piece of the background that the figure cut against. In painting he had found what a difficulty it would be to try to represent an object in one sweep. Most painters swept round their form, not caring what happened inside, and then they had got something to work up to.

The CHAIRMAN (Mr. Magnus) moved a vote of thanks to the readers of the papers. Those papers had given rise to an exceedingly profitable and interesting discussion. He did not think that any three gentlemen could have been selected whose experiences would have been more valuable to the section. They had had from Mr. Sparkes a most valuable exposition of the system of instruction adopted in South Kensington. It was too easy a thing—and he would almost say too common a thing—to decry South Kensington generally, and it was very well that occasionally an opportunity should be given to an able representative of that system to explain the careful manner in which instruction was graduated, and to indicate to what an extent that instruction bore upon the industries of the country. He believed that the whole country was very greatly indebted to South Kensington. Abroad the South Kensington system of instruction was held up as something which was well worthy of imitation, and the directors of nearly every applied Art School on the Continent had come over to England to see what was being done at South Kensington, in order that they might take advantage of the system of instruction which was there adopted. No doubt when the South Kensington authorities began their work they had to make tentative efforts; but all things improved as they went on, and he thought that it must be acknowledged that the instruction in applied art had very greatly improved within the last few years. He would quote only one instance which had come under his own observation. It was not very long since nearly all our great manufacturers had to appeal to Paris, or to Lyons, or to Bordeaux for designs for the work in which they were engaged. He was happy to be able to state authoritatively that that appeal to foreigners was very much less than it was formerly. In Nottingham particularly, the success of the art school had been very great. Not very long since the designs for nearly all the lace which was fabricated in Nottingham came from Paris, but now the large majority of the designs used in England were the results

of work done in the Nottingham Art School. As to the work done in Belgium, the Conference had been exceedingly fortunate to have the advantage of M. Couvreur to explain something of the excellent organisation of art teaching which was adopted in that country. He (the Chairman) had carefully inspected the art schools of Belgium, and nowhere had he seen any system which seemed better adapted, from the elementary schools up to the higher schools, for the training of industrial artists than that which existed in Belgium. His colleagues and he had been extremely pleased with the results of the work which they saw in Belgium, a great part of which had been recently organised. That work was so excellent that the Council of the City and Guilds of London Institute had asked Mr. Brophy to go over to Belgium in order that he might have an opportunity of seeing what was being done there. The main subject which they now had to discuss was art teaching in connection with the industries of the country. They were not considering the best method of training what had been called "picture painters"—such artists as exhibited in the Academy. They had to consider the kind of instruction best adapted to those persons who were learning art with a view of applying it to some industrial occupation. With some exceptions the discussion had been very well within the limits which had been laid down. It had been found necessary, in considering the subject, to go to the very first principles of art teaching, and to discuss the best methods, both in our Kindergarten, and in our elementary schools. They were very glad that they had had an opportunity of hearing Fräulein Heerwart, who was a great exponent of the Kindergarten system, and also of hearing Mrs. Westlake who was known to have wise and intelligent ideas on the subject, and who brought those ideas to bear upon the School Board of which she was such a worthy member. The question of art teaching in elementary schools was one of very great importance, and one to which the attention of the legislature must before long be directed. It was a recommenda-

tion of the Commissioners on Technical Education that drawing should be made an obligatory subject in all the schools of this country, as it was in nearly all the foreign countries which he had ever visited. In making that recommendation the Commissioners were somewhat disposed to take the view that had been advocated by Mr. Ablett, and to consider that drawing and writing were more intimately connected with each other than was ordinarily supposed. They had recommended that drawing and writing should be considered as one subject in elementary schools. An important question, which had not been brought under the notice of the section as fully as he had expected, was whether it was possible in the elementary teaching of drawing to commence at once with drawing from models, or whether it was necessary to begin with copies? In many of the countries which he had visited, if not all, models had been placed before the pupil at the very commencement of his work. The models were of a very simple character, but it was thought advisable to familiarise the pupil at the outset, however young, with the power of representing on paper the things themselves which he saw before him. In fact, the difference between drawing from a copy and drawing from a model was very much like the difference between learning a science from books and learning it from nature. After all, there seemed to be something in common between science and art in the best methods of teaching each: both in science and in art, the sooner we appealed to nature the better. The sooner the pupil was brought face to face with what was going on around him, the more likely was he to become proficient. A very important suggestion with regard to the teaching of art had been brought under their notice by Mr. Brophy and by Mr. Ablett. It related to the use of the brush. That was a technical matter upon which he did not feel himself capable of pronouncing an opinion; but he was quite certain that it was one well worthy of careful consideration. Mr. Tucker, who had spoken early in the debate, came from a very important

manufacturing district in this country, and he had been very praiseworthily endeavouring to teach art with a view to its application to designs for carpets. He complained of the jealousy that arose between the manufacturers in his district. There were probably very few manufacturers present at that Conference. If they had been present, they would have thought it desirable to say a word or two upon a question which so intimately concerned their own profits. He must own that in all discussions on technical education he invariably found that it was the manufacturers who were really to blame for not having sufficiently promoted, encouraged, and supported it. He was quite certain that in failing to help forward technical education the manufacturers were very blind to their own interests. Perhaps they themselves might not feel the loss which would be entailed upon the industries in which they were engaged. Their own profits might not fail for fifteen or twenty years, and possibly they cared little about the success of the industry in which others would be engaged after their time; but he was quite sure that manufacturers were shortsighted in the extreme in not doing more in their own towns for the promotion of technical education. Jealousy of the disclosure of trade secrets among manufacturers did not exist in the great manufacturing centres on the Continent. He believed that that was one reason why those manufacturers were so successful in the work which they carried on. Instead of competing with one another in the same town, they seemed to think that they ought to combine together to compete with the foreigner. He was sorry to say that the same feeling did not exist in the manufacturing towns of England. In Mulhouse, where the most beautiful cretonnes were printed, and where calico-printing was most successfully carried on, there was an industrial museum in which the designs fabricated by the various manufacturers of the place were exhibited for the benefit of all the inhabitants of the town. Thither flocked the artizans and the manufacturers, and they had the advantage of seeing all the designs which had been executed during the pre-

vious year. In the same museum were collected designs from foreign countries, with the object of familiarising the eyes of the artizan with the best work that had been produced. He felt quite certain that if the same public spirit animated Manchester which at present existed in Mulhouse, Manchester would have a far less successful rival than it had in the great industry which it carried on. Everybody knew that some of the best designs which were produced in this country were brought from France. The success of France was not due especially to its schools of applied art, for in the French schools the idea was rather to train artists than to train designers for special trades and industries. But what we did find in France was that drawing was better and more generally taught to artizan school children than here. And further, the museums in France were much more freely exposed to public visits than were the museums of this country. He attached considerable importance to that fact. He hoped that he might not be saying anything which would shock the section if he stated his belief that if our industrial museums were opened on Sundays, when our artizans would have an opportunity of visiting them, the change would do a great deal to improve the teaching of industrial art in this country. An attack had been made upon the system of payment by results. They knew that this system operated badly to some extent. Possibly it operated worse in the teaching of science than in the teaching of art, but, as Mr. Mundella had said only a few minutes ago in section *A* of the Conference, unless we were prepared for a complete revolution in our teaching, we must continue to retain this system. To his (the Chairman's) knowledge the system did not exist in any foreign country, but then we must remember that our school organisation in England was different from that of foreign countries. The remedy to alleviate the ill effects of the system of payments on results must come from that much-abused class of persons to whom he had already referred—the manufacturers rather than, from the State. When they and other persons in the large towns

were prepared to put their hands into their pockets to support the art schools as well as the science schools, by giving fixed salaries to the masters, then, no doubt, the effect of payment by results would be less injurious than it was at present. That time, however, had not yet arrived, and meanwhile we ought to be very grateful to the Government for the assistance which it had rendered to the teaching both of art and of science.

Mr. SPARKES, in reply, said that the discussion had wandered very considerably from the proposals which were laid down in the papers. They had discussed payment by results, and the teaching of elementary drawing, neither of which subjects was "in the bond." He believed that payment by results was the only system which the Government could adopt, up to a certain point, in subsidizing the schools of this country; but when questions of taste arose he objected to that system, for who could tell how far the result was right or wrong, though he was prepared to admit that payment by results could be made for work which could be properly judged of by accurate standards. As to the teaching of drawing in primary schools, a most successful effort had been made in Belgium to teach drawing to young children of six, seven, or eight years of age. In the third year, when they were only eight years old, they were able to produce original designs and to work to scale. This seemed to him to be far in advance of anything which we had done in this country. The whole arrangement of the schools in Belgium was different from the arrangement of English schools. The walls were lined with black-boards, and from the first the children were taught to use their fingers for the expression of their thoughts. In colour also the Belgian children were in advance of the English. They were taught to make cross hatchings, to represent tones, and to translate tone into colour. The question of colour of which Mr. Horsfall had treated seemed to him to be very seriously misunderstood. The colouring adopted in Flanders was conventional. There was no question that much might be

done by education in teaching, but it must be remembered that it was found that 16 per cent. of people were colour blind. A child with gift might be taught to make a good combination of colour. The whole of Mr. Ablett's propositions and the whole of his system were deeply interesting. He was not disposed to say that a child would draw very much better with a brush than with a pen, or a piece of charcoal. The main thing was to endeavour to make the children accurate. That was the moral of the whole thing. Some sentimental objections had been made to a hard and fast and repulsive method of teaching drawing; that was all very well, but they were hardly dealing with sentiment. It was necessary to be very matter-of-fact in training artizans to be accurate in understanding any drawings that might come before them. From the very first, design entered very largely into the instruction at South Kensington. Design entered into every one of the certificates, and the seventh certificate was wholly for design; and if an art-master went honestly and zealously through his curriculum he would know a great deal about the subject. Mr. Weale had condemned eclecticism, and said that art must be made national. The original idea of all art was common property. Gothic was shared by all nations, and it was qualified by the wishes of the nation in which it was developed. He could not conceive anything more narrow than to bring up a child upon Belgian Gothic, or early Belgian Gothic of the 13th and 14th centuries. These styles were hundreds of years behind. We did not wish now to live in houses or worship in cathedrals of that period, and he could not conceive anything more narrow than to confine an architect's education to a particular line, at a particular time, in a particular country. To his mind art was a much larger thing; and we could see the same principles underlying the Greek coin of 450 B.C. as in the very best Gothic work of the 13th century, or in the very best work which was turned out yesterday. Mr. Magnus had referred to the Nottingham designs. There had been a great fight as to

whether the Nottingham designs or the Paris designs should be used. He (Mr. Sparkes) knew as a fact that the best Nottingham designer had left his master on the question of pay, and gone to Paris. He now made his designs there, and some of the latest "Paris designs" were those which had been made by this Nottingham man, in Paris. He (Mr. Sparkes) believed that this Conference would do a great deal of good, and he thought that it was a pity that art teachers did not meet once a year to hear these matters out, and to try to produce a common fund of useful facts.

Mr. BROPHY said that he had only two points on which he had to make a little explanation. As to the teaching of elementary design, he thought that the first years of a student's life should be given to copying the best old masters, if for no other reason, to learn the *technique.* One of the best collections of drawings of the works of the old masters would be found in a book called the 'Album of the Renaissance,' which was now continued in another form, called the 'Art Pratique.' The other point came in accidentally, and that was, the attack which had been made upon payment by results. He felt that this was slightly personal, as he, with the help of other gentlemen on the Board, had to make these payments annually. Mr. Sparkes had put his finger on the weak part of the system, which was the payments made for works of taste in design. He would remind Mr. Sparkes that the payment made was not a complete payment for the work. It was a payment for what was considered a proper amount of work in the year.

Mr. ABLETT said that he was very glad that his paper had given an opportunity of holding a discussion to many people who felt strongly on the question of teaching drawing. He had felt from time to time that teachers were not going in the right direction. Mr. Sparkes had said that in the first place he would make the pupils accurate. There was, however, a very strong feeling abroad that that was not the first thing to be done. It

was sought first of all to cultivate the power which existed in the young child, and to allow technical skill to come forward spontaneously, without insisting too much upon it. He was sure from his own experience that if technical skill was insisted upon at first it did a great deal of harm. He was now trying the experiment of teaching a boy of less than four, to paint from nature without being able to draw. The child was set to copy flowers by making blotches for them and for the leaves, and was allowed to select the colours for himself. He found that drawing from real objects could be practised as a first exercise, if a selection were made of those which were flat and placed so that no difference existed between the real and apparent form. He did not think that in teaching drawing from objects which had length, breadth and thickness, it was necessary to begin by giving a course of perspective first. That was quite at variance with the method of teaching other subjects. The first thing was to give the pupils a knowledge of facts, which could be easily done by aid of a glass plane, and to come to principles afterwards. He was hopeful that this discussion would lead to a new state of things in elementary drawing.

Mr. B. ST. JOHN ACKERS then took the chair, and the following paper by Professor GINER DE LOS RIOS was read by Mr. S. H. CAPPER :—

SOME ACCOUNT OF THE TECHNICAL EDUCATION IN THE "INSTITUCION LIBRE DE ENSEÑANZA" AT MADRID.*

By Professor GINER DE LOS RIOS,

Of Madrid University, Delegate of the "Institucion."

I RISE to address you on behalf of a nation which, from circumstances that would require too long to explain, does not figure in the present Exhibition. But in recent times there can be no gainsaying a movement of ever-increasing force in that country in favour of national education in conformity with the spirit of modern progress, from which alone the nations can hope for regeneration.

In 1868, universal freedom in teaching was established under the ministry of Señor Ruiz Zorrilla; in 1869, an eminent Professor, Señor Castro, founded an association, which has since steadily increased, for promoting female education; and in it a chair for teaching the principles of Fröbel's system. In 1876, thanks to this movement, a Kindergarten was founded by the Government in Madrid, as also an official chair of the same subject in the male and female training schools. In 1881, we held an Educational Congress; and in 1882, the Central Normal School of female teachers was reorganised, while the re-building of that for male teachers was begun, and its reorganisation would follow; the infant schools have been placed entirely in the hands of female teachers, for which purpose a normal course for the preparation of this new staff has been created in accordance with the principles of Fröbel; the salaries of the masters who were more modestly remunerated have been increased; and an interesting statistical report on primary education has been lately published by the "Direccion de

* Translated and read by S. H. Capper, M.A.

Instruccion pública." Finally, an educational museum has been established, the organisation of which, differing as it does in important particulars from that of similar institutions in the rest of Europe, will be submitted to your consideration in the proper section of this Congress by the director, Professor Cossio.

In addition to these changes made by Government, for which we are indebted especially to Señor Albareda, the Minister, and to Señor Riaño, the Director of Public Instruction, the number of elementary schools has been increased, though perhaps not very extensively; school buildings and school furniture are being steadily renovated, and some steps are being taken for their endowment with apparatus for scientific instruction; the Government has laid down definite conditions with which all new school-buildings must comply in order to receive the Government grant. But what is of even higher significance, slowly but invincibly the schools are being penetrated with the new educational spirit of modern times, as shewn by the development of excursions, manual work in school, instruction in natural science, drawing, and even modelling, and the substitution of those realistic and intuitive methods of teaching, which aim at developing the faculties in the actual presence of things, for the old system of starvation by the mechanical and verbal study of text-books.

This progress is due to the general advance throughout Europe of educational ideas, and to the consciousness of the necessity of giving a more practical and fruitful character to our national education. But it has been very largely initiated by the "Institucion Libre de Enseñanza," which I have the honour to represent at this Congress, and which forms more especially the subject of this paper.

First, however, let me say a few words with regard to official technical education in Spain. It is but just beginning, but we possess, (*a*) in Madrid, a great school for artizans, unfortunately without practical workshops, but where there are night classes for drawing, modelling, mathematics, and industrial chemistry, physics, mechanics,

&c.; (*b*) in all the capitals of provinces, and in many other of the more important centres, night schools for mathematics, drawing, and modelling; (*c*) some schools for foremen miners of a fairly complete and practical character in the principal centres of the mining industry. I should also mention the lectures and classes of a similar character for workmen in Madrid, held with great success by a private society called "*El Fomento de las Artes.*"

Moreover, in many of the Institutes of Secondary Education, there are drawing classes, not, however, obligatory, and in some of them theoretical classes of science as applied to industry and commerce. Finally, in higher technical education we have the ordinary schools of civil and mining engineering, of architecture, agriculture, and forestry. Their chief fault, one unfortunately too common on the Continent, is the excessive preponderance of the theoretical side, and the want of practical work, which fault I am happy to say is now at any rate beginning to be felt, and remedied, as is shown by the school excursions recently organised in the School of Mines.

The Institucion Libre de Enseñanza (of which "Free Educational Institute" is but an inadequate translation*), is a private corporation, founded in 1876 by voluntary subscription, for the purpose of co-operating in the general progress of education, which object is carried out by lectures and various publications for the dissemination of its principles, but above all by their application in the actual classes of the Institucion. At present there are about 200 pupils, no very great number; but the curriculum embraces a complete course from the infant school up to secondary education, and even scientific investigation. Of the contributions—as yet but small—that Spain has been able to offer to the work of modern science, many of the more important works on philosophy, geology, astronomy, chemistry, jurisprudence, history, archæology, and other branches, are due to the professors of the Institucion. I have placed on the

* "Free," that is, from government or clerical supervision; the instruction is not gratuitous.

table, at the service of the members of this Congress, one or two copies of our "*Boletin*," or fortnightly journal, and a few educational pamphlets recently published by us, though I must express my regret that the fact of their being in Spanish will, I fear, greatly preclude you from giving us your criticisms and opinions, which we should have highly appreciated.

The Institucion Libre de Enseñanza has the honour of being the first institution in Spain that has introduced manual work throughout the *whole* course of elementary education, and is perhaps the first in Europe to have made it compulsory in the secondary course, on the ground of its being an absolutely indispensable element, not only of technical education, but within certain limits, of *all* education that is rational and human. Owing unfortunately to our very limited resources—for the Institucion has never claimed, nor, as a fact, does it receive any aid or subsidy whatever from the State, or from the local corporations of Madrid—we have only been able to embrace the following subjects (in addition, of course, to the work of the Kindergarten classes), viz.:—

(1) *Drawing*, always from the cast, or from nature, *never* from prints.

(2) *Modelling*, begun last year in the infants' school. Arrangements have now been made for its extension throughout the school next year.

(3) The making of topographical *reliefs* from the contour lines of the Ordnance Survey maps, of which plaster casts are afterwards taken.

(4) *Carpentry*, from the age of nine or ten years. The pupils of the higher classes have already made various articles of furniture for their schoolrooms; but the character of their work is essentially educational (as urged by M. Salicis, the eminent director of the Normal School for Manual Work recently founded in France, in the manuscript note prefaced to his book exhibited in the French section).

(5) *Lathe-turning* is now being introduced, and is to form part of the regular course next year.

(6) The *construction* both of geometrical bodies in pasteboard, and of certain of the less complicated apparatus for elementary lessons in chemistry and physics.

I might also in a certain sense include under this head the formation of herbariums and small collections of natural history (in its various branches), as well as the practical laboratory work in chemistry, which the pupils carry out by themselves after the age of twelve or thirteen. Before concluding the course of secondary education they are sufficiently advanced to spend their last year in solving some of the simpler problems of chemical analysis.

As far as manual work is concerned, that is what is being done in the Institucion during the course of general, *i.e.*, elementary and secondary education. But I must point out with some emphasis that we do not regard the two courses of primary and secondary education as distinct. On the contrary, they are conducted on absolutely identical principles. There is no solution of continuity; so entirely is this the case that the programme of study is, with the exception of classical and foreign languages, essentially the same right through, from the infant school up to the degree of Bachelor, which is, in Spain, the termination of the secondary course. The programme naturally commences on what I may call almost microscopic lines (lines which are nevertheless always solid and useful for life), and is gradually and steadily differentiated and unfolded throughout the course.

We hope to do more in time; amongst other things, to accomplish a systematic union of this manual work with that of the Kindergarten, of which it should be the direct outcome; but, as Dante says, hell is paved with good intentions, so I will confine myself to what the Institucion has actually done.

For those pupils who have finished their course of general education in the Institucion, and who decide to enter the technical professions, manual education naturally takes a further development. In addition to carpentry, turning, modelling, and drawing; to the practical work in the labora-

tory, in topography, and in construction; to excursions, both botanical, geological, mining and industrial, &c., they began last year to pursue work in iron for some 2½ hours three times a week. So far this work has been confined to filing and fitting, but they are to begin immediately metal turning, and will go on to boiler-making, studying at the same time iron-casting in its different operations. With these additional studies they have what may be considered the common basis of all manual education for the different technical professions. As our means have not allowed us as yet to finish the building we have begun for the Institucion (and of which I submit a short description, which you will find on the table), we have been obliged to take advantage of the generous hospitality of Señor Bonaplata and of the Spanish Southern Railway Company; the former has placed at our service his large iron-foundry, the latter their extensive railway workshops. In these our pupils work under the direction of a man of competent technical knowledge, who in the most disinterested fashion thus provides them with a very real technical education. Otherwise they would have to undergo a working apprenticeship which, in spite of the traditional practice in England, is, I venture to think, full of serious inconveniences.

As an indication of the aims and guiding principles of the Institucion Libre, I will briefly enumerate the work actually done last year (*i.e.* Oct. 1, 1883—June 30, 1884) by the pupils in our polytechnical division. Their average age is fifteen years, and they have simultaneously pursued their course of general culture, including study and class work in philosophy, literature, &c.

They have carried on their special work in mechanics, experimental physics, and chemistry, both inorganic and organic, this including practical work in the laboratory, with discussions and lessons on the problems and theories occasioned by the various work, of which they have to make epitomes, submitted, at intervals, to the masters.

In botany, they have studied practically botanical physiology, exercises in the formation and classifying of collec

tions, their studies being carried on both in the botanical garden of Madrid and in the country.

Geology and mineralogy, including crystallography and crystallographic optics, as well as petrography, *i.e.*, microscopic geology. They have made geological excursions for the purpose of examining the various formations and of collecting and classifying rocks, minerals, and fossils (these last but slightly).

Zoology, much less extensively, but next year they will study it under the form of comparative anatomy and physiology.

Elementary mathematics completed and mastered by way of preparation for the higher theories of algebra (following Baltzer's method) and analytical geometry.

Descriptive geometry, the bare elements.

Meteorology and astronomy, the elements with exercises and experiments.

The French and English languages have been continued, and they are to begin German next year.

This is what they have done on what I may call the pure science side. In applied science, *i.e.*, technical education proper, the studies have included the following :—

Construction. Practical work in applied mechanics, the calculation of resistances ; drawing and laying out of plans, calculations of cost, and similar work, combined with the study of works in actual construction. They have simultaneously studied the history of architecture by means of photographs and excursions to the principal monuments of Spain, which they are already to a large extent familiar with, and of which they make, as far as possible, general sketches and drawings of details.

Steam Machinery. The practical study of those which they have seen in operation in the workshops, with the theoretical study which naturally is thus aroused. Two of the pupils have, besides, been exercised in the actual handling of these machines, learning, for instance, how to fire them and start them.

Topography. Field work with theoretical lessons upon it, and the practical use of the principal instruments.

Mining. Metallurgy and mine working; they have not as yet made any metallurgical experiments in the laboratory, but in company with the professors (one of whom I may mention is a distinguished English engineer, Mr. F. Gillman), they have visited various important mining establishments, as, for example, Almaden (mercury), Reocin (zinc), Mieres (coal and iron), Cáceres (phosphorus), &c.

Agriculture. Field work and excursions for the purpose of studying at first hand the working and various operations of the principal rural industries; of these they make notes which form the basis of the lessons. I should add that they have not this year done anything in the way of industrial chemistry, but it will form part of their course next year.

From this imperfect sketch some idea may be gathered of the technical education of the Institucion Libre, which is endeavouring to follow, however humbly and afar off, in the feeble measure which its limited resources permit, the example of those institutions, like the École Polytechnique and the École Centrale of Paris, the Technikum of Winterthur, the Polytechnikum of Zurich, &c., which aim at developing simultaneously, at least for a period of greater or less extent, those various studies which constitute the general basis of the technical professions.

In order to make our standpoint perfectly clear, I crave your indulgence in allowing me to conclude this sketch by stating *seriatim*, and with the barest amplification, the principles which in our opinion ought to govern all professional technical education.

(1.) Technical education is a consistent and systematic whole, governed by one spirit and scheme; the chasm which at present separates the different grades of (*a*) workmen, (*b*) foremen, (*c*) and master engineers, architects, &c., ought to be absolutely bridged over, for it is perfectly false to maintain that the one class should be formed in the workshop and solely by empirical and manual practice, and the other in the theoretical school without any practical study whatever. This is a glaring fault common to almost all the higher technical schools of Europe, in opposition to which it is easy to understand the English preservation of the

mediæval system of apprenticeship in many of these professions, with a view to assuring at least a certain degree of practical skill, which is for the most part lacking in those engineers who have only passed through the theoretic schools. It is perfectly clear that the workman needs an amount of manual skill which is unnecessary for the engineer, but the latter cannot afford to be destitute of all practical knowledge, lest, as not unfrequently is the case, he remain entirely at the mercy of his subordinates. On the other hand, the workman cannot fail to benefit enormously by a rational understanding of what he is doing; moreover, it must tend to awaken in the lower grades faculties which may have lain totally dormant for want of cultivation and all possibility of advance from one grade to another. I must not omit to take this opportunity of congratulating most cordially the City and Guilds Institute for the great progress it represents in this direction with respect to higher technical education—due largely, as you know, to the excellent Report of the Royal Commissioners—nor, at the same time, of offering my humble meed of praise on the establishment in France of *écoles d'apprentissage* invariably combined with industrial workshops. Apprenticeship carried through in the workshop is necessarily fragmentary, not graduated nor systematic; all it can do is to take advantage in the most economical manner of the working energy of the artizan; it is not possible to ask of it real education, nor can the master—the master engineer, for example,—be always sufficiently competent in the very varied studies which in the higher grades are required.

(2.) The workman, like the engineer, must start with a general education, fuller, and more fully subdivided in each grade as you go higher up, but in all solid and integral, (which is quite a different thing from the question of the quantity and extent of the knowledge imparted). This is the mission of the two courses of elementary and secondary education, between which, I venture to repeat, it is false to draw a hard and fast line of separation, for in reality they form a continuous and progressive whole, at any point of

which the pupil ought to be able to leave with an all-round basis of those elements of education which are necessary to the life of any man worthy of the name. This general education is the sole means of awakening the true bent and aptitude of the pupil. It is already being felt, and that none too soon, to be a very grave evil when young men of families in an independent position, choose their professions, as is often the case, for wholly insufficient or erroneous motives, ensuring thereby a certain loss both to themselves and society as a whole ; but the evil is just as great in the case of the workman who is forced on by hard necessity, yet who might be able to make a choice did the integrity of his elementary culture give him the chance of his doing so.

(3.) But this choice of profession cannot be made in a really rational fashion if the passage from general education to the speciality determined upon be sudden and unprepared for. The specialization must be gradual. And this renders necessary the establishment of a polytechnical preparation before entering upon any particular branch, for three reasons : (1.) To ensure a choice based upon due knowledge ; (2.) To acquire the basis which is common to all the principal technical professions ; (3.) In order to make the transition from one to the other of these in each case with the least possible friction and difficulty.

Such a preparation has great advantages over those usually in vogue which only embraces certain branches, more especially drawing and mathematics, and which does not lead properly up to its true object. To do this, the subsequent studies should simply be the continuation and amplification of the preparatory, and the preparatory should have been begun from the very first. That is to say, that this, as indeed all education, should be all along cyclic and concentric ; it should from the first embrace one and the same programme to be gradually developed and amplified. The true preparation for any study is the study itself in its most rudimentary form, not another study more or less heterogeneous.

(4.) and lastly. During the whole course of technical

studies, general education and culture should not be abandoned, for a man does not cease to be a man on becoming an engineer. Thus, a mining engineer, for instance, ought to continue simultaneously with his more special studies, though of course somewhat less amply than these, his training in the pure sciences more closely connected with his profession, as physics, chemistry, geology, &c. He ought strenuously to endeavour to keep open and awake that scientific spirit, on whose progress, as the Commissioners for Technical Education have said in their report, really depend all the arts and technical applications of science. Further, as the compensation of specializing, so as to avoid partiality, narrowness, and exclusiveness, and so as to keep the spirit unfettered and flexible, and assure that free commerce between the general and the special which is the first guarantee of the latter, it is absolutely necessary to keep the spirit open to all the great problems of universal human interest. Just as the lawyer, the man of literature, and the philosopher are ashamed, and with reason, to be absolutely ignorant of the theories and discoveries of a Darwin, or not to know what is meant to the world at large by the great names of a Bessemer or a Siemens; so the engineer should be equally ashamed to be unfamiliar with Shakespeare, Kant, or Rousseau, or the principles of the government of nations.

To all this, perhaps one objection will be raised, viz., "that it is impossible to do so much; that human life is not long enough for it all."

In answer, we can only have recourse to the old and well-worn, but tolerably secure expedient of the philosopher who proved the possibility of motion by walking himself. What we preach we are practising, and if this can be done in Spain, which I sorrowfully confess to be terribly backward and behindhand, why should it be impossible amongst nations like England, France, Germany, Italy, and Belgium? The secret of the possibility of resolving this problem is contained in the old adage, cited (though in a different sense) by Lord Reay, "*non multa sed multum.*" It would indeed be impossible had we to follow the cramming system

that obtains in certain countries, did we try to overload the pupils' intelligence with an enormous quantity of work, of subjects and details, all of which doubtless would be very useful had they not to be learned at the cost of sacrificing either subjects of even greater interest, or, what is worse, the fresh and spontaneous intellectual development of the pupils. In other words, in following the system of the Institucion Libre de Enseñanza, a pupil on leaving will possess knowledge, say, of architecture, which in quantity is much less, but in quality is indisputably greater, higher, and more solid.

I make bold to affirm that in England, if anywhere, we shall find sympathy with our determined opposition to cramming and over-pressure in education. Precisely one of the things which Continental education has to learn from the English is *sobriety*. It is not for me to discuss the programmes of education in England in the various grades, nor have I the presumption to set myself up as a judge; but I venture to uphold that, in a large measure, England owes the solid character of her education to the limited number of working hours a week, to the careful proportion between work and rest, and, above all, to the just equilibrium in education which is maintained by the immense development of physical exercises and games. To this also must be attributed the remarkable fact that it is in England that are found in their most minimized form the various defects in organization which have been discovered by that spirit of reform which is now moving the country, and of which this Congress is so patent a token.

The following paper, by M. C. de BOSSCHÈRE, was next read.

THE TEACHING OF NATURAL SCIENCE IN THE PRIMARY NORMAL SCHOOL, BELGIUM.

By CHARLES DE BOSSCHÈRE.

Professor in the Teachers' State Normal School, Lierre; and in the Normal Division of State Female Teachers, Louvain.

HISTORICAL SKETCH OF THE CONDITION OF THIS TEACHING IN BELGIUM.

THE organic law of 1842, which continued in force for thirty-seven years, did not embrace the teaching of the natural sciences in Belgium. Schools which embraced this class of instruction were the exception. Occasionally, in city schools, an attempt was made in this direction, which was chiefly limited to selections found in the school reading books, or they were made to consist of purely mnemonic exercises. Elsewhere, among the data showing the course of instruction, was found an inscription, entitled 'Intellectual Exercise,' which, if accepted as indicative of the general intelligence of the teacher, gave a poor account of his ability. As a rule, such teaching was limited to the learning and recitation of definitions relating to the various parts of the human body, the divisions of time, the succession of the seasons, and similar subjects. Object lessons, which, based upon the rational principles of intuition and experiment wisely employed, might have given the children useful and solid information, were, for the most part, limited to readings or dictations on a number of heterogeneous objects, with their inter-relation, the utility of which was at least questionable. Schools in which teachers gave serious lessons on common objects were extremely rare under the law of 1842, and their number never reached a fair average.

Eastern Flanders signalized itself in a movement which

attracted the attention of all who were interested in natural science teaching in Belgium. The Provincial Inspector, Mons. V. J. Germain, made most praiseworthy efforts to popularise elementary ideas of science, which are indispensable to those who desire to occupy a fitting place in a progressive country like ours. Many schools were distinguished for the zeal with which their teachers sought to make the pupils acquainted with elementary ideas of zoology, botany, and even chemistry, which last is of the utmost importance in an agricultural province. Still, a dark side might be shown to this otherwise pleasing picture, for in many cases, teachers in this province were content with causing their pupils to learn such elementary scientific ideas from the school reading books. Though we must refer to this method later in our brief paper, we must here state that it can never be productive of serious results ; it teaches neither to see, to observe, nor to experiment ; it is absolutely void of interest, being wanting in life, which is the essential attribute of all scientific teaching, whatever be its scope.

In connection with this Flemish province we must name Luxembourg, which, for many years, was famed for possessing a governor who was a true friend of teaching, Mons. Van Damme, whose efforts succeeded in popularising natural science.

It was reserved, however, to the Belgian Educational League to enter resolutely, and without heeding the clamours of the disciples of an effete system, upon the only rational, broad and fruitful method, which inculcates observation and direct experiment. By its *Bulletin* and its lectures it entered boldly upon the struggle for the development of the sound pedagogical principles of Coménius, of Jean Jacques Rousseau, Pestalozzi, Frœbel, Desterweg, and many others of the same class. To effect this, the League resolutely protested against limiting the minds of children to the narrow circle which only embraced religion, reading, writing, and arithmetic. The members proclaimed aloud that the child should be placed amid nature's manifestations ; that he should be taught to live in their midst

and appreciate them ; the child was, in one word, to learn all that it could possibly master that is true, beautiful, and good in the sublime Work which, unfortunately, is so little known by so many of our kind, owing to the defective education received in youth.

The League was not satisfied with calling the attention of the friends of instruction to the course which should be pursued by school authorities ; they determined to give practical proof that what they championed was feasible. For this purpose they founded a model school, of which it is quite easy to speak, since many of the members of the International Congress of London visited it while at the Congress of Brussels in 1880. It was at this school that the first attempts were made to cause the adoption of intuitive methods, of which we shall later give details. Still, we may here mention in passing that such was the success of this tentative movement, that the Liberal Government did not hesitate, in 1878, to adopt this system of instruction for its primary and normal schools.

M. Germain, who had in the meantime been named Director-General of Primary Instruction under the new Minister of Public Instruction, issued a programme which may be considered as the official approbation of the arduous labours of the Model School of Brussels. From that moment an impulse was given to the work. Every teacher put his hand to the plough ; lecture-courses were organized, in which the new methods were explained ; normal schools were furnished with the implements needed in the new order of ideas ; master and pupil vied in interest ; elementary instruction made rapid strides, and won the hearts of the people. To M. Germain is due the honour of having thus admirably organized the teaching of the natural sciences. It is this teaching which we shall strive to develop in this paper. We owe this to the inauguration of the work which we now propose to discuss.

OBJECT—CHARACTER—METHOD.

In the Kindergarten we must strive to give primary development to the perceptive powers, to the observant faculties, through the senses. We should likewise encourage the imitative instincts of children, and strive to awaken their inventive powers.

This first development of the most valuable faculty in childhood must be continued in the primary school, where the teacher is bound to awaken the observant faculties, in combination with those of reflection. As was well remarked by M. Tempels in his inaugural address at the Model School in 1875, the true mission of the primary school is to give birth to the desire for instruction, by preparing the understanding to seize the meaning of things. Now, the first essential of success in this effort is found in the development of the senses. As aptly said by M. Germain in his report to the School Investigating Committee:

"I shall not enumerate the advantages which the natural sciences offer for the development of the senses, of the intellectual faculties, of æsthetic and moral taste, of their adaptability in practical life, their reference to agriculture, &c., and elsewhere: "The method which permeates the entire programme, is the method of intuition, the method of observation, of experiment and analysis. To teach man to correctly see things, and to apprehend their harmony, is to give him that peculiar bent of mind which reacts most favourably and in the greatest measure upon all his faculties."

From the principles just enunciated, it is evident that the author of the official programme holds that the acquisition of knowledge depends upon the exercise of the senses. In this he is in perfect accord with all pedagogic authorities. This exercise begins in the Kindergarten, and should be continued in the primary schools, where it will form the basis of all teaching of the natural sciences. It is needless to remark that there can be no such thing as the teaching of

science in the full sense of the term in elementary schools. We only claim that children must acquire such knowledge as may reach them from observation, by the well-directed use of their organs of sense. In other words, our teaching must have a specific character; it must either be rational or cease to exist. We repeat, the object sought is to give the children such notions of things as to enable them to continue their studies by the practice of self-help; to direct their faculties, so as best to serve their after welfare, by the formation of a sound judgment.

Long since, great philosophers and illustrious pedagogues had shown the necessity of this teaching, and the course to be pursued in its development. It is not necessary to demonstrate the utility of this teaching; it is not contested, nor does any competent authority seek to urge doubts in this respect. Still we believe it well to recall the opinions of a few master minds:

Bacon, in the sixteenth century, speaking of scientific studies, says: "It is not in books that we should study stones, plants, and animals, but in Nature itself, which can alone correct false impressions, and enrich the mind with increased knowledge."

Montaigne in turn exclaims: "Mere mnemonic information is not knowledge, this is to make the memory a mere lumber-house. We labour to store the memory, while we leave the understanding, the conscience, void." He then shows us the course to be pursued: "Begin by showing things to the child, then let him taste them; next, let him discriminate and choose for himself; let the little one hide all that is mere borrowed matter, and show what he himself has done with the material at his disposal."

John Coménius, another illustrious pedagogue who lived at the beginning of the seventeenth century, and to whose genius we owe the organization of studies such as we find them to-day, introduces the principles of observation and intuition in the plan of studies he proposes. "During the first six years the child should be made to lay the foundation of all scientific knowledge needed in after life. Make

him study nature by observing stones, plants and animals, and also teach him to make use of the various muscles of his body. Here you introduce natural history and physical culture; teach him to notice colour, and thus give him the elements of optics, and by listening to different sounds develope first notions of acoustics; by leading him to watch the star-dotted firmament, he learns astronomy, while geography is gently taught by inducing the child to notice its own cradle, the room in which it dwells, the neighbourhood and the adjoining country. Later, chronology will naturally follow, when he is taught to notice the regular succession of day and night, the divisions of time, the hours, days, weeks, months and festivals. Simple talks at home will give him an idea of political economy, while arithmetic may easily be begun by simple references to the things bought or sold in his own home. Geometrical information will naturally follow if the child is taught the dimensions of bodies, the character of lines, surfaces and solids. The child listens to singing and learns to emit the same sounds, and thus imperceptibly he is taught to reproduce musical phrases; grammar is taught each time he is corrected in speech, or that new words are suggested, while the elements of rhetoric are inculcated when he is encouraged to express his thoughts most effectively by gestures as well as words. Thus, the maternal school develops the germs of all sciences and of every art."

The creation of object or intuitive teaching, which is the only form of instruction we can endorse for primary schools dates from Coménius. "It is a fundamental error," he says, "to begin by words and to proceed thence to things, to mathematics, natural history, &c., for things are the substance, the body, while words are the mere accident, the dress in which the body appears. These two parts of all instruction must be united, but we must begin by things, which are the object of thought and of speech."

"We must, in the earlier stages develope the senses by observation; then the memory, next the understanding, followed by judgment, for science takes initial steps by

observation; the impressions received are afterwards fixed in the memory and the imagination; then the understanding seizes upon the thoughts which memory has collected, and draws general ideas therefrom, finally, the argumentative faculty draws conclusions from things which are sufficiently known and co-ordinated in the understanding."

"It is not the shadow of things which makes an impression upon the senses and the imagination, but the things themselves. Hence it is necessary to begin by genuine intuition, and not by mere verbal description of objects."

"Let words and things, things and words, go hand in hand," said Coménius. Since that, a rectification has been made, which reads: "Things before words, words for things, words to indicate thoughts."

All words which go to enrich the child's stock of language should be so many *facts* which his memory retains.

Upon the exact development of the senses depends the exact culture of the mind, and upon this last, all human culture in development.

It does not appertain to the nature of our thesis to multiply authorities, else it would only be necessary to draw unreservedly from the writings of Locke, Desterweg, Pestalozzi, Frœbel, Jean Jacques Rousseau, Spencer, and Bain. This we deem needless. Let us add, in conclusion, that "we depart from Nature's path each time we employ sounds and words, instead of real things, as the basis of intellectual culture, and as the first means of developing innate power." Thus speaks Pestalozzi.

Let us then summarise by stating:

1. The teaching of natural science in elementary schools should be based upon the direct observation of real objects.

2. That this observation may be useful, it is necessary, previously, to exercise the organs of sense.

3. Intuitive exercises are, *par excellence*, those which best develope all the intellectual faculties.

4. The knowledge acquired by the study of the natural

sciences is indispensable to every man who would occupy a fitting place in our civilization.

Thus far we have only considered intellectual culture. Moral culture, however, is not neglected. This is evident from the declaration of M. Germain, quoted at the opening of this paper. It also follows from the very nature of this instruction. It is impossible that the study of Nature and her phenomena should not exercise a most salutary influence, morally considered. He who loves Nature bears within him a source of the purest joys; he who seeks to explain to himself the secrets of Nature's phenomena will be neither superstitious nor superficial; he will be possessed of common sense, the undeniable indication of a sound mind.

The Programme.

Later, we give the programme of natural sciences as taught in the model and the elementary schools (see Appendices I., II., pp. 317–333). It is not to be expected that we should develop the entire programme, we content ourselves with giving some of the procedures by which the second programme is developed, this we do by several examples. Those who desire to make a complete study of these programmes may consult 'The Model School,' published at Brussels by Gustave Mayolez, 1880, and the Official Programme for Primary Schools, of July 20th, 1880, as furnished to the Committee of Investigation on Schools, Brussels, F. Hayez, 1882.

It should be remarked that the system adopted for the preparation of this plan of studies for primary schools is devised on the principle of Concentric Courses; three degrees tally with what may be considered three concentric circles.

Let us represent the first degree by a circle divided into several sectors, each of which represents a speciality of instruction. During the first two years the child is supposed to pass through the various sectors, and finally to reach

the circumference, which is their limit. In the second degree, the child is placed again at the centre of the same circle, and then goes over the same topics. Next he proceeds to go beyond the first circle, in all directions, and at the end of this second course he has attained the limits of a larger circumference. The space which is found between the two circles, embraces the *ensemble* of the branches studied in the second degree. The rest is easily understood.

Many criticisms have been made upon the programme of the course of natural sciences. M. Germain summarises these in the following points.

1. The programme is too extensive and scientific ; it is not sufficiently practical.

2. It is feared that certain lessons tend to lower the moral tone of the child by assailing his modesty.

3. The introduction of scientific terms into the elementary school is not desirable.

4. Too much time is devoted to this teaching.

These criticisms, which may easily be refuted, and which have been abundantly refuted by the originator of the programme,* may possibly be repeated at the London Congress. Hence, we shall rapidly refer to some of them.

1. The programme is too scientific. It is the label which in this case frightens those who content themselves with the mere name of the thing contained : Elementary notions of Natural Sciences. The author of the programme admits that the word science does not appear to advantage therein, and excuses its use by replying that it is the term used in the law. We beg to say that we are not of his opinion. Has any clamour been raised against the terms history, geography, geometrical forms, &c.? Perhaps there were also such objections made. Does any one imagine that children study history because they learn a few historical data? I would certainly be inclined to resist the use of the term history, and to declare that the expression "elementary notions of natural sciences" is infinitely better adapted to

* See "Statement," p. 330

convey the idea of intuitive object lessons than is the term history to imply what is usually couched under that term, when the teacher employs it to designate the manners and morals of savage or civilized peoples. But we must expect to meet short-sighted people; the better plan is to pay little heed to their criticisms, and to allow time to prove the wisdom of our work.

The programme of natural science studies should be so arranged that all its parts will co-ordinate, so that the teacher may not be expected to give separate courses of lessons in botany, zoology, and chemistry! The order which reigns in the lessons of reading, writing, and arithmetic, should be found in every branch, for order in labour is an assurance of its success.

3. The introduction of scientific terms into the elementary school-room is not desirable. Here a distinction must be made. This criticism must not be applied to the schools of Flanders, for all the terms which the teacher may employ should form part of the language of the child. The case is different with Belgian children, who are taught in French. Here, again, a distinction must be made—"Where there is question of an idea, a notion which it behoves the child to learn, the teacher must use such terms as will convey the idea. A solid limited by six rectangular faces is a rectangular parallelopipedon; this is the correct term; no other can be employed. The teacher who calls such a solid an elongated cube talks nonsense. There can no more be an elongated cube than we can have a long square."

"On the contrary, if the idea can be conveyed in ordinary, simple terms, the scientific expression should be avoided. Let us take an example: thus we have the cruciferæ which contain six stamens, of which four are longer than the other two. These are termed tetradynamous. Now, such a term is useless in the primary school. It is much better that the child should be allowed in his own language to say that this class of flowers has six stamens, of which four are longer than the other two." (Declarations of M. Germain.)

It is thus with all Greek and Latin terms which have become more or less Gallicised, and which may easily be replaced by ordinary terms. It is merely a question of tact.

4. Too much time is given to this teaching.

"Let us, for a moment, examine the time allotted to each branch.

"We may select the third degree in boys' schools.

"We should group branches treating of morals, literature, writing, and the mother tongue; history, geography, and one modern language. To these, fifteen hours out of twenty-eight are allotted.

"A second group, consisting of arithmetic, the metrical system, geometrical forms, and drawing, calls for seven hours weekly.

"To a third, embracing the natural sciences, three hours are apportioned.

"To a fourth, embracing only singing and gymnastics, three hours are also given." (Declaration of M. Germain).

It is not possible to take exception to the time given to natural sciences, especially when we bear in mind the service such studies render to the mother tongue. Indeed, we need but recall the many exercises in composition and language strictly considered, which are closely allied with lessons in natural science. We might, without exaggeration, state that each of these exercises is an admirable instrument for the formation of the habit of observation, and that of correct expression, to which, with great reason, we attach the highest importance.

* * * * *

We now proceed to state the programme. The first degree comprises:—

I. Man. The chief external members; preliminary notions of the organs of sense Hygienic advice; cleanliness of the body and of dress. Certainly this is quite simple.

II. Animals. Familiar talks about domestic animals; birds beloved by children; the best known fish. The master shows a stuffed animal to the child, or where

this cannot be procured, a picture. This is described by the children; the habits of various animals are dwelt upon, and the services they render are detailed.

III. The Vegetable Kingdom. Work similar to above is given about trees and garden flowers. The programme requires that the most generally diffused injurious plants shall be shown; the child's work consists in merely being able to recognise such.

Children who attend the two lower classes are required to make a herbarium. Much ridicule has been created by this regulation; why, we are still at a loss to determine. It is true that to collect specimens requires much time and patience from the teacher, but this is not a reason why we should forego a task useful in so many ways to youth. In this way the child learns the names of many plants, acquires habits of order, of economy, of classification, &c., all of which have great educative value.

IV. Minerals. In this class of teaching the master is expected to hold pleasant talks with his pupils upon the mineral substances best known in the vicinity, and also upon the metals, most generally employed or found; as occasion requires he will speak of coal, iron, lead, sand, slate, &c.

V. Finally, the teacher should show his pupils that bodies are presented to us under a triple aspect; solid, liquid, and gaseous. He should make some simple experiments to show that air is material, and which will elucidate some of the ordinary properties of gas. To complete the Kindergarten lessons, he will call the pupils' attention to the various colours, to the decomposition of solar light, and in these cases he will merely state the facts without seeking to explain them.

We may now pass to the second degree.

I. Man. To the instruction already given should be added a very short description of the skeleton and first ideas regarding the chief functions of life; digestion, circulation, respiration. It stands to reason that detailed explanations are out of the question where the phenomena of life are concerned, since such details would demand chemical infor-

mation beyond the reach of children. It is simply required to make the children acquainted with the most elementary illustrations, that they may establish the most essential rules of hygiene, know what is found in the body, and what occurs therein. Unfortunately, the human body is too little known. Yet this knowledge would enable anyone, to a very great extent, to preserve health intact.

II. Animals. The note placed at the close of this division of the programme explains its object and extent. It is there stated: "We should be careful to emphasize the characteristics of each group, and to point out some of the useful or hurtful animals which belong thereto.

Let us take as an instance *the rodents*, and see how the lesson may be given.

It must be borne in mind that in the previous degree (1st), the children have studied the *quadrumana*, the *carnivora*, and the *insectivora*. Each lesson must be coordinated with the preceding. Having placed a stuffed squirrel, or a picture of this animal before the class, we might ask the children if the squirrel eats meat like the cat. Ordinarily, it eats nuts, or gnaws the bark of trees. In forest districts we often see nuts which have been stripped by squirrels. They have gnawed away the shell to reach the kernel within, which they eat with a part of the shell.

A cat would not be able to gnaw in this way. The cat does not gnaw, but the squirrel gnaws. Here is a first difference.

The teeth and jaws of the squirrel must, therefore, be constructed differently from the teeth and jaws of the cat.

Is it natural that the back teeth of the squirrel should be sharp and cutting like those of the cat? On the contrary, they are flattened, but on their top surface we find little burrs, like the face of a file. In front we find enormous teeth of great strength, trimmed as it were, to a sharp point; there are two above, two below. These enable the squirrel to pierce the hard portions of its food, and to break it into pieces; these pieces are next ground and cut up by the other teeth.

The squirrel uses its file-like teeth to gnaw. Let us see how we use a file to work upon a piece of wood, and we shall have an idea how the squirrel uses its lower jaw with the upper. This study will reveal that the squirrel moves its lower jaw forward and backward and *vice versâ*.

In this way we shall have established the distinctive characteristic of the rodents. We have selected our illustration from an author who combines in a very marked degree the knowledge which is indispensable, and the *savoir faire* necessary in teaching the natural sciences. We refer to M. GASTON BONNIER, of Paris. It is in this way that we answer those who pretend that the master has not within his reach the necessary helps with which to prepare these lessons. It will not be denied that works suited to the teaching of the natural sciences may be found in most countries.

Having examined the teeth and jaws of the squirrel, or instead, the cranium of a rabbit or hare, we should next speak of the external characteristics of the animal; we should say some few words about its habits, which amounts to saying that we will seek the picturesque side of the lesson, which, if we choose, may precede the previous part. It is quite possible to teach children from 9 to 11 the notions of natural science called for in the second degree; in regard to animals this may be considered as finally settled.

III. Plants.—This point embraces three parts: 1. The study from chosen types of the chief organs of the plant. We do not for a moment admit that such a lesson may be learned from a book. The child must be led to observe, to analyse, and to dissect the chief organs of a typical specimen. This is evidently a most important exercise, which may be made very attractive. It will suffice to dry the leaves that have been studied and the separate parts of the flower. Then let these be pasted with great care, and in due order, on a sheet of paper, each part being labelled correctly.

2. To study a typical specimen of each of the following families: (See Appendix II., page 330.)

We might, for instance, take the wall-flower (*Cheiranthus Cheiri L.*), which has been so beautifully described by J. J. Rousseau, in his 'Letters on Botany'; but we prefer to select another; one of the *Papilionaceæ*.

Each child is furnished with a branch of the cultivated pea. Then a simple description is given, in which all terms unknown to ordinary language are eliminated, and the root, the stem, the leaf, the flower are each referred to, and the fruit shown and examined. We pay special attention to the leaf, which has at its base two large ears called stipules. It is important that the child should find for himself that the calyx forms a sort of small cup having five teeth; next the children separate the five petals singly, the teacher being careful to make them notice the special form of the corolla. Each petal is spread out carefully; there is a standard, two wings, and a keel. The form is that of the papilionaceæ. The reason is given for this name, and we should not hesitate to state that it is a misnomer.

The children next remark a very fine tube of a pale white colour and very thin, which at its upper extremity is divided into two very fine filaments, each of which supports the anther, or the pollen sac. This tube is detached, and is split its full length with a pin, and is held between the eye and the light; it will easily be found that these are the stamens of the pea-flower, whose filaments are, as it were, united the greater part of its length. This will be noticed for the first time, and cannot fail to impress the imagination of the young investigators, who will thus remember the fact without any trouble.

When the children have removed the stamens, the pistil still remains, and in this they will easily recognise three parts: the stigma, the style, and the ovary. This last deserves special attention. The pupils should describe its form; they should divide it with a pin, following one of the sutures, and discover the small seeds. This should be followed by an examination of the pea pod.

At this stage we should recapitulate and insist upon the characteristics of the leaf, and especially of the flower. The

children may be told that this plant belongs to the family of the leguminosæ, and they should be encouraged to examine other plants which may be pointed out to them.

Besides the specimen which should be placed in the *Herbarium* (third section of this series of exercises), and the dissection which should be made, there is also an important home work or exercise to be written on this subject. We will not dwell upon this point.

IV. The Minerals.

Let us suppose that the specimen selected for this lesson is found in a clayey district, and that the earth there found is manufactured into bricks. Will it be difficult to give the pupils some elementary notions about the clay? They daily see how the clay is taken out, and whence it comes. The teacher procures a piece, gives a small portion to each child, and has a class-talk, of which the following may be the chief points:—

Clay is soft to the touch (let the children prove this); it is a fatty species of earth which sticks to the tongue (make the experiment). If this clay is mixed with water, it can be worked into models by the hand (let this be done in class; it has, indeed, already been done in the kindergarten). The clay thus worked may be made into any desired form (here the children may be allowed to form geometrical designs, or any other that they choose). Now, if the object thus made of clay is baked, it will become as hard as a piece of brick (the teacher might, for instance, bake a piece of clay at the kitchen fire). This piece of baked clay is not soft, it does not adhere to the tongue; if water is poured upon it there is no effect produced, we cannot mould it as before. This clay has then completely altered its characteristics. It has acquired a property which is most useful, and is availed of largely by man.

In this way we would prepare a lesson on the following:—

V. General Notions on Industries (see Appendix II., p. 331).

Visit a brick-field.

It is scarcely necessary to say that it is intended that the pupil should see the various operations in their simplest

forms. Yet there is a point which may be lost sight of, and which, if neglected, may render the visit to the brick-field void of results. We refer to the preparation for this visit, by a lesson such as we have described above. A visit made without this preparation amounts to nothing, and is a mere loss of time. During the visit it is necessary to watch that the pupils see the various operations in their regular order, from the extraction of the earth from the soil, to the carting of the brick to the place of sale. Thus understood and practised, a school visit must be productive of the happiest results upon the intellectual development of the children.

VI. Elements of Physics (see Appendix II., page 331).

Very simple things require but few lessons. We will fully develop one referring to our fourth section. It will be an explanation of the wind.

Take a lamp-chimney, or a gas-globe, and place it upon two pieces of brick or of wood, so that the base may be almost entirely free. We now light a short piece of candle, place it between the two bricks or pieces of wood, then above the flame we place the chimney or globe. Now take a piece of silk paper, or a fine feather, and hold either above the glass, when it will be perceived that the paper or feather is raised a certain height. The same phenomenon is not seen when the feather or paper is held directly over the flame. We may conclude at once that a current of air is produced in the globe, and that it is this current which raises the paper or feather. Whence comes this current? The cold air which surrounds the glass enters, and, being heated, it rises.

The same thing is noticed when we hold a candle above or below a door, which establishes a current between a room which is well heated and another less so. The cold air comes in below; this we can easily tell from our feet becoming cold. Having become heated, this air rushes out above, and thus we determine that a draught is established above and below. Chimneys which carry off

heated air will help to develop the idea which we have treated of in the two preceding illustrations.

Such are the preparatory exercises. How shall we now find the point of departure from which to elucidate the phenomena of wind.

Let us suppose a part of the earth heated ; the warm air will rise as in each of the three preceding illustrations, and will be replaced by the cold air, as we have likewise shown. From this there arises a constant air movement, a current which is nothing else than wind. It suffices that a part of the earth is heated more than a neighbouring section for a current of air to be at once established, the cooler air moving towards the region of the warmer.

How may we determine this direction? We may be dispensed from furnishing illustrations on a point so simple.

We can easily see that by a series of such exercises children may be led to understand the formation of fogs, clouds, rain and snow.

Let us cast a glance over the Third Degree.

I. Man.—Here we shall merely find the extension of the exercises given in the first and second degrees. As in the case of

II. Animals.—We proceed with the synoptic table showing the classification of animals already known, "which is a sure means to see the course pursued and to revivify the ideas already acquired." Then follow "conversations on the mammalia which destroy insects, on birds, reptiles, and the batrachia, useful to the agriculturalist."

III. The Vegetable Kingdom.—The first point deserves our attention—1. To observe (*a*) the phenomenon of germination in the bean, or in a grain of wheat ; (*b*) the various phases of the development of plants.

Nothing is simpler than to illustrate the germination of plants. If the master has a garden, nothing need prevent him from carrying out this part of the programme ; if not, he may at least cause grain to germinate in small pots, in

the class-room, the same being equally easy for plants. If he has no flower-pots, germination may be developed on a sponge, which he will be careful to keep moist.

It must be borne in mind that the teacher is not supposed to explain the phenomena which succeed each other in germination. It will suffice for him to point it out.

No serious difficulty need be experienced in the various phases of the development of plants. The teacher can readily divide the subject matter: there are annual, biennial and perennial plants.

Among the latter, some lose their leaves annually; others are ever-green. As soon as Nature awakes from her winter slumbers, it will suffice, daily, to observe what takes place in the different categories of plants named. These daily observations accustom the child to keep his eyes open, to drink in the wonders of nature, which are a limitless source of pure enjoyment.

In regard to plant families, it is well to urge their study still farther, and to seek above all to generalize.

Let us select an instance. Let us suppose that there is question of studying the family of Rosaceæ, at the moment when the strawberry, the apple, and the pear and hawthorn are in flower.

We confine ourselves to the examination of those organs only which, either by some peculiarity or by their number, affect the determination of the species of the family. In this way we examine in turn the leaves, the flower, the calyx, the corolla, the stamens, and the pistil.

We note the peculiarities of each of these organs in the strawberry, with which we begin the series of observations.

In the same way we analyse each of the three other species.

We arrange the notes in the following order:—

	Strawberry.	Apple.	Pear.	Hawthorn.
Leaf .	Trifoliate, with 2 stipules.	Simple, with 2, caducous stipules.	Simple, stipules 2, caducous.	Lobate, stipules, caducous.
Flower	Regular, hermaphrodite.	..	..	..
Calyx .	Gamosepalous, quinquedentate, epicalyx.	Gamosepalous, quinquedentate.	..	..
Corolla	5 petals, free caducous.	..	..	..
Stamens	20	15 to 30	15 to 30	15 to 30
Pistil .	Many	5	5	1
Style .	Many	5	5	1
Ovary .	Many, free . .	Single, united to the calyx, and consisting of 5 carpellary leaves.	..	Single, united to the calyx.

By means of this table it will not now be difficult to find the points of likeness common to the four plants examined, and to conclude from the concrete to the general.

The characters common to the Rosaceæ are therefore :—

1. Leaves with stipules.
2. Flowers regular and hermaphrodite.
3. Calyx gamosepalous and quinquedentate.
4. The corolla consists of five free and caducous petals.
5. Stamens, indefinite, attached, with the petals, on a disc, which is formed by the thickening of the rim of the calyx.
6. Ovary, simple or compound ; free or united to the calyx.

Of these characters the most important are the last two, and the pupils must be made to notice this fact.

It will not be necessary, we think, to insist on the importance of the process of generalisation, which we have just sketched.

To what we have already said concerning the study of plants, let us add that drawing must play an important part in every lesson. The teacher ought to be able to draw rapidly, with a few bold strokes, the shape of the leaves,

flowers, fruits, longitudinal and transverse sections of organs; also diagrams, &c.

The pupils too should be trained to the same kind of work.

The third point of this part of natural science speaks of collecting specimens. We have already said that every visit made by a class should be prepared for beforehand; this applies also to collecting. The preparation, excepting the material part, is made during the lessons, such as the one on the Rosaceæ. After such a study collecting will be useful. The work to be done is threefold:—

1. The pupils look for plants of the order Rosaceæ; they must make sure that every specimen they collect really belongs to the order.

2. They will look for specimens of the species previously studied; this will be a very valuable repetition.

3. The teacher directs the pupils to collect such plants as may be required for a future lesson, or for any other purpose.

We cannot dilate at greater length upon this interesting subject.

IV. Minerals.—Reference is here made only to those minerals which are common in the locality. The notions which the pupils must acquire are most elementary. The object sought is, that each pupil should make a collection of minerals; or, when circumstances do not permit this, that each should at least contribute to a general collection for the school.

V. Notions on certain Industries.—In our mention of the visit to a brick-field, we have briefly shown how such visits should be made. We do not repeat those remarks, but we will only observe that this part of the programme is carried out only in so far as the teacher finds the means in the neighbourhood.

VI. Elements of Physics.—A careful perusal of the programme of physics for the third degree, will show at once the possibility of giving such instruction to children of the ages between eleven and thirteen years; espe-

cially as there is no attempt at doing so in a scientific point of view.

Thus, in the first place: some general properties of bodies: divisibility, porosity, compressibility, elasticity, certainly require nothing save intuitive demonstration; special definitions of these properties, giving rise to discussions among the most noted physicists, demand a measure of information which is not expected in primary schools.

How to develop the Programme.

We have rapidly sketched the programme of natural sciences and the way to develop it. We have striven to give a general idea as to how it should be interpreted. It now remains for us to indicate, quite briefly, the means of success which are at the disposal of ordinary teachers.

It must be stated that when this programme was inaugurated in its full rigour, most teachers did not possess the requisite qualifications for such teaching. But, be it said to their credit, that they went to work courageously. The Government came temporarily to their aid by the establishment of courses of lectures. Four such were opened at Brussels, Ghent, Antwerp, and Liège. Each of these courses was followed by those teachers who were deemed most apt in the natural sciences, and these received lessons from distinguished specialists from the University and from Normal schools. These courses of lectures took place during the holidays of 1881, 1882. A special diploma entitled the professor, in turn, to communicate his acquired knowledge to his *confrères* of the district. Thus, all the teachers of a section of country were expected to perfect their information, and thus to prepare themselves for the development of the national programme for the teaching of the natural sciences.

Terminal lectures greatly assisted teachers in the task imposed upon them, while the pedagogical journals completed the work, by publishing model lessons on the subjects involved.

The zeal shown by master and pupil was admirable.

Aided by the enlightened views of the Government, and especially of M. Germain, the Director-General of Primary Education, who organised courses of science, and proposed to the Minister to institute competitions with a view to the formation of collections of scientific objects and apparatus, special collections were made of the most appropriate specimens for illustrating lessons in natural science, which must be regarded as of great importance.

It need scarcely be said that all the requisites for such instruction cannot be found in ordinary schools, taking into account the heavy expense entailed for such material. But, we may say that our day schools in the larger districts are provided with every necessary specimen; moreover, in each large section there is a school museum in which the teacher may obtain every information needed for his pupils.

Unfortunately, time fails us to undertake the defence of a theme which we have already frequently defended—that in its essential features, our programme of the teaching of natural sciences may be realised without a museum, and without a varied collection of animal specimens, minerals, &c. We may even say that lessons given without the appliances referred to, so far as primary schools are concerned, will be all the more valuable, for they will be more popular, more in keeping with the mental calibre of the labourer's child. This has been shown by many country teachers, who have elaborated simple methods of illustration, costing little, and yet quite adapted to their range of instruction. The London International Health Exhibition has many such collections, and we trust that many such will be found at the International Exhibition of Antwerp.

Hence, if the Belgian Government has lavishly employed its wealth in endowing our country with the means for scientific teaching in keeping with the demands of the times; if it has encouraged teachers in their difficult task; we have also seen this same Government casting its glance upon the future, organising in its schools a system from which it has a right to expect the happiest results. We

shall examine this organisation in a cursory, yet [illegible] manner.

Natural Sciences in the Normal School.

Before studying the actual organisation of the [illegible] courses of natural science, it may be well to show [illegible] had been done previously to 1881 in this special ground.

"But one hour a week was allotted to the n[illegible] sciences in each of the divisions.

"The pupils received no ideas of chemistry; peop[illegible] lost sight of the fact that the knowledge of the gases [illegible] air, and the study of combustion and its products are [illegible]lutely necessary as bases of hygiene.

"The programme of zoology was traced in broad out[illegible] The author had, doubtless, intended to render it simpl[illegible] easy. By inscribing thereon the announcement "[illegible]cipal kinds of vertebrata, their distinctive characte[illegible] had given it an unmeasured length; for, taken litera[illegible] announcement demanded the study of the princip[illegible] of mammalia, birds, reptiles, batrachians, and fishes.

"The course in botany had been reduced to its [illegible] expression: it comprised merely some ideas of [illegible]graphy and descriptions of a few plants. Phy[illegible] classification, collecting, all seemed to be of n[illegible] whatever.

"Not one single lesson was devoted to mineralo[illegible] that in a country where mining industry is so active[illegible]

"Scholastic hygiene was restricted to as narrow a [illegible] as possible.

"The elements of horticulture and arboricultu[illegible] taught, but no attention was given to agriculture

"Nothing was prescribed concerning the emplo[illegible] the intuitive method and the forming of collectio[illegible] pupils." ('Organisation, Material, Administrati[illegible] Pedagogical, of the Primary Normal Schools in [illegible] By V. J. Germain, Director-General of Primary Edu[illegible]

In 1881, the Minister of Public Instruction, publ[illegible] new programme of studies.

"The reform in the teaching of the natural sciences does not only consist in the introduction of lessons in chemistry, mineralogy, scholastic hygiene, and in the separation of the courses of botany and agriculture; it bears more particularly on the character, and even on the spirit of these courses. Convinced of the negative results of a teaching whose foundation was a series of verbal descriptions, the Government has wished the course to be based on observation and experiment.

That teaching which rests on these bases, which constrains the student to render an account of his own discoveries, which directs his attention to the research of scientific laws, which makes reason seek the causes of hidden phenomena; that teaching, in fine, which inculcates the love of creation and makes its eternal beauty felt, is the only one which can transmit to young teachers the living knowledge of nature, leave them throughout life a profound impression of the wonders observed, and make them acquire the precious talent of creating in the minds of the children the thought which enlightens, the sentiment which warms, and the activity which creates."

The intuitive, experimental, and practical character of the teaching of the natural sciences in the normal school is clearly marked in the recommendations placed at the head of the programme, and which, we regret, want of time and space prevent us from reproducing. We refer those of the members of the Congress, who might desire to make a complete study of teaching, as it is organised, to the programme and general regulations for normal schools, or to the work of M. Germain. We shall content ourselves with briefly indicating what is done in each of the branches of the sciences.

I.—Chemistry.

It is not a course of chemistry which is given at the normal school; there could be no question of that. It is only desired to treat, in the shape of an introduction to the natural sciences, the matters entirely indispensable to the study of important questions of physiology and hygiene.

the nature of water and of air, the properties of the gases which constitute these fluids, combustion and the deleterious gases which it produces, the chemical phenomena which are daily accomplished before our eyes, the first elements of their nomenclature.

These few notions are taught in a manner wholly experimental; the pupils ought, as far as possible, to aid the professor in the manipulations, and in actually preparing the different gases. At the Normal School of Lierre, we shall even be in a position, starting next year, to have all the experiments made by each pupil. The experiments are made in the simplest manner possible; the end pursued is twofold: to make the experiments understood, to have them explained, to habituate the pupil to render an account to himself of natural phenomena, and also to organise them after such a fashion that the future teacher may be able to repeat them without too much cost.

II.—Zoology.

We make use in the normal schools of a collection of stuffed animals, of animals in alcohol, of models in plaster, or in composition *carton-pierre* of Dr. Brock, and of Dr. Auzoux. It is necessary to have them frequently handled by the pupils. For this purpose, the lessons are given by means of these objects. The professor requires the pupils to know how to explain them from the different points of view prescribed by the programme, and at the oral examination, at the end of the first and second years of study, they are called upon to furnish proofs of the use they have made of the collections.

In our normal schools, the pupils of each of the three courses, may make use, on the days and at the hours fixed by the regulation, of all the specimens of the museum of natural history. They besides form collections of insects, of shells, &c.

When the normal school is situated near a museum of natural history, either public or private, the pupils visit it

during the course of the scholastic year, under the direction of their professor. It is thus that the pupils of the normal sections of Brussels and Louvain frequent the Royal Museum of the capital; the latter is besides visited, at least once, by the pupils of all the normal schools. The Zoological Garden of Antwerp receives frequent visits from the pupils of Hoboken, Antwerp, and of Lierre. These last visits are particularly instructive, because of the large number of living animals to be found there; observation and study are more complete than at the museums.

III.—Botany.

This course is exclusively practical. The pupils have to form a herbarium conformably to the programme of the first two years of studies; in order to facilitate the study of botany, the pupils of the normal schools of Lierre and Louvain are obliged to prepare a minute dissection of a type belonging to each vegetable family, and to complete this work with all the notes proper to furnish the *ensemble* of the characters of the different vegetable families. They exercise themselves in the determination of the plants with the assistance of the scalpel and microscope; they make frequent collecting-excursions and visits to the neighbouring botanical garden, if the thing is feasible. A small botanical garden is annexed to all our normal schools. Then, where the soil permits, there is reserved to each pupil a corner of the garden, which he sows and cultivates according to his taste. These may be seen in the Belgian department of the International Exhibition; and the plan of the botanical gardens of the pupils, such as organised at the normal section of Louvain.

Each normal school possesses a microscope, objects of demonstration, and wall boards.

III.—Elements of Mineralogy.

Time does not permit of a regular course on the properties and classification of minerals being given at the

Normal School; but in a mining country like Belgium, it is desirable that the teacher should know the most useful mineral substances, that he may study them from the point of view of their chief characters, of their locality, and of their employment in the arts.

It is to this minimum that the requirements of the programme are reduced.

We possess in all the normal schools fine collections of minerals; a great number of small collections have already been formed, of which some figure at the Exhibition.

IV.—Physics.

This branch is one of the most important in the course of the natural sciences, and the programme indicates in a most precise manner the subjects to be taught. As regards the lessons in chemistry and, in general, for every course of natural science, the professor, says M. Germain, shall attach great importance to daily exemplifications, for the explanation of the phenomena of which we are at each instant the witnesses; and he shall strive for clearness and recur to the simplest experiments, and those easiest to repeat. He shall banish from his lessons algebraic formulæ and calculations; he shall have it at heart to make many experiments, not as subjects of amusement, but as means of illustrating the laws of science. He shall habituate his pupils to manipulate, to make simple apparatus; he shall encourage them to construct small instruments fit to demonstrate certain principles. He shall never lose sight of the elementary aim of the teaching of physics in the primary school, and he shall not consider his task accomplished when he has terminated the exposition of his programme, but only when he shall have acquired a proof that the pupils, without requiring complicated appliances, are in a state to instruct children in the physical phenomena of daily life and the employment of some simple instruments.

Already in some of our normal schools the pupils are

able to exercise themselves in the construction of small appliances, thanks to the provision of benches devoted to carpentry. It is even to be hoped that we shall produce pupils who, on leaving the normal school, may be able to construct the instruments and appliances which they may need in their lessons in the primary school. We are in this matter, as likewise in the other branches of natural science, only in a trial stage. Some time is yet required before our courses are completely organised according to the rational principles of observation and experiment. This does not prevent us from affirming that the teaching, as done nowadays, is a teaching which shall bear manifold fruits, and form masters who shall be convinced partisans of the methods recognised by all serious pedagogues.

V.—Hygiene.

The programme of this branch sufficiently demonstrates the importance attached to its teaching in our normal schools. We are of the opinion that it will be necessary to try to attach the notions of hygiene to those of physiology and anatomy more closely than is the case now, in order to prevent the course becoming extended out of proportion with the other matters on the programme.

N.B.—We pass over in silence the courses of agriculture, horticulture, arboriculture, and domestic economy, because we do not occupy ourselves especially with their teaching.

General Observation.

All branches of Natural Science are taught with a special view to the primary school.

Another help of great value, in the study of natural sciences, is free-hand drawing. We do not think it necessary to insist on that point; no one will contradict us. Pupil-teachers must therefore be urged to practise themselves in drawing sketches of the apparatus they use, outlines of animals, sections of the various organs,

diagram of flowers, sections of a mine or quarry, &c. It has often been remarked that drawing is a language both clear and concise, understood by everybody. Teachers should be very anxious to become well skilled in this art, which can be of immense service in their lessons.

CONCLUSION.

This work was asked of us eight days ago, when we were engaged in the examinations of the second and third year pupils of the normal schools of Lierre and Louvain. Hence we have not been able to bestow sufficient time upon it, in order to present suitably, the work done in our country since 1880. We regret this, for, had circumstances permitted, we should have liked to trace out complete tables of the progress achieved in the teaching of natural science; and this might have interested some of the members of this Congress.

We had intended to point out what still remains to be done in order to complete the work so well begun by the Minister of Public Instruction.

We have been obliged to content ourselves with sending to London a mere outline hurriedly sketched, and very incomplete.

The elections of last June have modified the legislative body. The liberal Cabinet has been replaced by a Catholic Ministry.

There are some who fear that the attempts already made to introduce the teaching of natural sciences into primary schools, will be nullified; others think that the new ministry will stop the final organisation, and the necessary outlay for the science teaching in normal schools.

We have no such fears; the stream of scientific work, which in this century of progress impels us forward, will not be checked by the popular political opinions; it will make its way. We are firmly convinced that the government will not ignore this movement.

P.S.—Just as this notice was going to be posted to

London, the project of the reform of primary instruction has been sent to us. We transcribe the following passage from this memorandum :—

"The knowledge of geometrical forms, and elementary notions of natural sciences, are less the object of a course of lessons, strictly speaking, than matters for observation and conversation ; of course, it is useful to give an insight into these things to children before they leave school, but we cannot require that they should form the object of lessons in all the communal schools, and be adopted in the country ; some notions of agriculture would be more useful in country schools."

We have not time to examine this extract. Let us say, however, that natural sciences will be sacrificed in a great number of schools ; this will be regretted by many competent persons, and not without reason.

APPENDIX I.

PROGRAMME OF NATURAL SCIENCES, MODEL SCHOOL, BRUSSELS (1879–1880).

I. Exercise of the Senses.
Development of five primitive faculties.

First Degree.

1. *Sight.*

1. Colours and their shades. To distinguish and name them : to produce secondary colours by combination.

Solar Spectrum : Decomposition of white light (2nd year).

Newton's Disc : Recomposition of white light (2nd year).

Formation of collections of coloured objects (threads, papers, tissues, &c.).

Polychrome Designs.

2. *Hearing.*

Exercises in distinguishing various sounds, their cause, whence they proceed, &c.

Exercises in distinguishing sonorous bodies, non-resonant bodies, &c.

(See programme of music).

3. *Touch.*

1. Exercises in distinguishing degrees of temperature, cold and heat, and their variations.
2. Exercises in distinguishing and qualifying the difference of surface presented by various bodies. (Degrees of smoothness or roughness; pointed bodies and blunt ones; degrees of elasticity.)
3. To distinguish solids and general geometrical figures by mere touch. (See programme for Geometry.)
4. Exercises in distinguishing weight of bodies. (See programme of Arithmetic.)

4. *Taste.*

Exercises in distinguishing various tastes and their differences.

5. *Smell.*

Exercises in distinguishing and naming a series of odours, and their shades of difference.

N.B. -In the other degrees the master seizes every opportunity, and profits by all circumstances which present themselves; he even gives rise to occasions to exercise the pupils' senses, and to make them apply the various portions of the programme.

II. BOTANY.

A.—Display of a series of a dozen plants with conspicuous flowers. Select the types characteristic of families.

Notions on the form, dimensions, colours and smells of each.

Purpose of the stem as a support.

Choose living plants, or coloured sketches, trace or sketch their design.

B.—In the second year add a dozen typical plants to previous, and so choose as to give an idea of multiplicity of form; also knowledge of forest trees.

Root, stem, flower, leaf, fruit, seed, with exercises in distinguishing each in the plants studied.

Shades of green in leaves; colour of the parts.

Designation and frequent repetition of the names of plants; show their utility.

In each class teach children to dry plants, their parts, and to place same in their herbaria.

Exercise pupils in placing on boards, longitudinal and transverse sections of the trunks of trees, their bark, a leafy branch, the flower, the fruit, &c. The teacher will form a herbarium and a collection of specimens of trees for his class.

SECOND DEGREE.

A.—A summary analysis of entire plants; roots and parts, stem, branches; leaves and parts; flowers; calyx, corolla, and petal; nectar; andrœcium, stamen, filament, anther; carpel, ovary, style, stigma.

In herbarium collections, collect plants typical of families, and show their parts; compare these, show in what they differ, and in what they are alike.

B.—Analysis of plants collected. Notices of the vegetable family.

Analyse a type of each family. Compare them. Determine their characteristics.

Collect in a herbarium all the plants studied.

The teacher should prepare one as a model.

THIRD DEGREE.

A.—Collecting for herbaria, dichotomous analysis, new families. Classification of leaves, corolla, inflorescence, fruits. Collection of types of these organs.

B.—Plant life.

Microscopic observations on the lower plants. The idea of the cell generalised for the entire vegetable kingdom.

Intuitive demonstration of endosmose.

Experiments showing absorption by roots.

GERMINATION: cause a large grain or seed to be examined, and indicate its daily evolution.

Some experiments with the seed of cruciferæ and of papilio naceae, &c.

The hourly evolutions should be noted.

This embraces all the physiology and organography taught.

Inhalation by the plant; show the error of the spongiole theory.

Mechanism of fertilisation.

Microscopic studies in the inner structure of plants, cells, fibres, epidermis, peridermis, cambium, pith, physiological phenomena of plants.

Show that fundamental differences between the animal and vegetable kingdom hold good so long as we speak of animal and vegetable in the superior classes; but that these differences vanish when we descend to the lowest stages of the organic scale.

General study of natural classification.

Have the herbarium systematically established.

N.B.—This entire programme is taught from studies or *observations* made by all the pupils indiscriminately. No theory may be established, no definition given, save in the superior classes, when the necessary observations have been made. The pupils are trained to sketch, *from memory*, the plants and portions studied.

III. ZOOLOGY.

First Degree.

I. Knowledge of the Human Body (Visible Portion).

1. Head, neck, trunk, members.

The same names are given to analogous parts in animals.

(Take instances from a series of animals: the dog, cat, horse, cow, sheep, goat, bat, cock, hen, &c.)

Animals in which one or more of these parts are wanting (the crocodile, frog, serpent, fish, worm, leech, star-fish, &c.).

2. The Head.—Distinguishing and naming of parts: the cranium and hair, the face or countenance.

In the face: two eyes, two ears, a nose (two nostrils), one mouth (two lips), eyelids, eyelashes, head. The name of the nose and mouth in certain animals (dog, lion, birds, &c.).

Parts of the mouth: two lips, two jaws, three species of teeth (eight incisors, four canine, eight small molars, twelve large molars; in all thirty-two teeth).

Teeth in certain animals: monkey, dog, cat, cow, rabbit, serpent, fish, &c.

3. Neck, throat.

4. Trunk: breast and belly, back and thighs.

5. Members: two upper, right and left arms; two lower, right and left legs.

In animals: anterior and posterior members—feet, wings. Creatures which have more than four members: insects, spiders. wood millipede.

Upper members: the arm, fore-arm (wrist), hand (palm, back, fingers; names of the fingers).

Lower members: thigh (knee), foot (sole, heel, instep, ankle, toe).

N.B.—Show these parts on the child's body; repeat same on a series of animals. Render these lessons interesting by some anecdotes about these animals.

II. The Human Skeleton.

1. Distinguish—
    1. Three great osseous cavities: the skull, thorax, and pelvis.
    2. Two osseous arches: thoracic (shoulders), pelvic (hips).
    3. The arches support four members: the arms and legs.
    4. The skull, the thorax, and the pelvis are united by a column half solid, half hollow—the vertebral column.
    5. The skull, the thorax, and the upper members rest on the hips; these latter on the lower members, which, in turn, rest upon the earth.
2. Distinguish between the long, short, and flat bones.

Distinguish between the paired bones (eighty-two) and the unpaired bones (thirty-four).

3. Give numerous exercises on the names and positions of some of the principal bones.

4. Show skeletons of different animals, and compare them with that of man, without entering into details. Always show the mounted animal, or if possible a living one, at the same time that the skeleton is exhibited. Thus:—

    1. Monkey: striking resemblance to man.
    2. Bat: hands changed into wings.
    3. Mole: predominance of anterior portion of the body and limbs.
    4. The cat: peculiarities of dentition.
    5. The hare: elongation of face; dentition.
    6. Seal: transformation of posterior portion.

7. The boar: change of extremities; diminution of the number of fingers and toes.
8. The sheep: dentition, change of extremities; still greater diminution of fingers and toes.
9. The kangaroo; dentition, marsupial bones; strength of tail.
10. Dolphin: pisciform transformation of the skeleton of the mammalia.

5. Familiar descriptive history of these animals.

Second Degree.

A revision of studies of the skeleton; names of chief bones. Cause them to be found in skeletons of different animals. Collect the bones together, and cause children to make up the arm, a leg, the vertebral column, the skull, the whole skeleton.

Digestive organs:* the mouth, tongue, teeth, glands, œsophagus, cardiac, pylorus, peptic glands, duodenum, liver, pancreas, small intestines, large intestines, rectum.

Study this division in Auzoux's model, or on the anatomical sections by Dr. Bock, &c. Place these parts in the skeleton.

Show the digestive organs of a ruminating animal, of a bird, an insect. Show that it is more complicated in these animals.

Fourth Year.

Skeleton—Articulations.

Alimentary system—Superficial views from the mouth to the rectum; Sympathetic vessels wherever found; chyliferous vessels throughout region of the intestines.

Substances assimilated: 1. Solution of sugar (glucose); 2. Solution of albumen (peptone or albumenoid); 3. Fats in solution or in emulsion (as in chyle); 4. Soluble salts; 5. Water.

Review a series of infusoria, worms, molluscs, insects, crustacea, fish, mammalia, and show how their development increases in perfection as we approach the higher forms of animal life.

(The simplest case is that of the infusoria, which are fed by the simple endosmose of the liquid in which they are immersed. A

* Distinguish accurately between system and organ. A system is a collection of organs, always performing the same functions; an organ is a limited portion of the body which may serve various functions. Thus: respiratory system; the organ known as the tongue.

first step in development is seen in the worm, whose only organ is a tube passing through it, and in which it digests its food. This animal, turned inside out like a finger of a glove, continues to nourish itself through the interior tube, without the least trouble.)

N.B.—Always require sketches to be made from the specimens shown.

Third Year.

1. Circulatory system :—

    (*a.*) Heart: arteries, capillaries, veins (this is the simplest case, and that most generally diffused).

    (*b.*) The apparatus is more complicated in man and in the mammalia: right ventricle, lungs, veins; left ventricle, arteries, capillaries, &c.

2. Secretory apparatus.

3. Respiratory apparatus in man, in fish. Double breathing in amphibious animals.

Teach these matters from Auzoux's and Dr. Bock's models, &c. Show coloured illustrations indicating such apparatus in man and in some animals.

Cause theoretical sketches to be made illustrating circulation.

4. Resume the study of skeletons. Compare that of man with that of a bird, a reptile, a batrachian, or a fish.

Cause pupils to notice the development or the degeneration as the case may be.

5. Mammalia. Insist on the anthropomorpha, quadrumana, useful insectivora, small indigenous carnivora, the horse, porcine, bovine, and ovine species.

Birds. Insist upon the insectivorous *passeres* of the country, the domestic *gallinaceae*, the *palmipedes*, and *grallæ* (those classed as game.)

Reptiles. Insist upon local specimens.

Fish. Insist upon those used as food, and oftenest found in our markets.

In the Superior Class.

1. Nervous System. Brain, cerebellum, organs of sense. Motor nerves, sensory nerves, nerves of vegetative life. Ganglia (minute local brains found in various parts of body). Muscles and movement.

2. General review of mollusca and of annelida. Insist upor

the insects hurtful to agriculture. History of bees, wasps, common ant, white ant, and cockchafer.

Make collections of the animals studied.

Study their natural classification.

Mingle the specimens of animals, and require the pupils to classify them in the school museum.

3. Natural history of Man. Probable date of his appearance upon earth. Successive states:

1. Brute state (vanished).
2. Savage state. (Exs.: Fuegians, Esquimaux, Ostiaks.)
3. Patriarchal state. (Exs.: Arabs, Nomad tribes.)
4. Barbarous state (sedentary, agricultural tribes, ever at war.) (Ex.: Turcomans.)
5. Semi-barbarous (cities, industries, laws applied to the entire people). (Ex.: Belgians in Cæsar's time.)
6. Civilized (arts cultivated, letters and sciences developed). (Exs.: Ancient Egyptians, Romans, &c., Belgians of our own day.)

N.B.—Lessons in Zoology are always given with specimens of the animals treated of. Coloured pictures are used in connection with mounted specimens or skeletons. As far as possible, pupils should be taken where they can see the living types.

In every lesson on Anatomy the professor must include ideas of Hygiene.

IV.—MINERALOGY—CHEMISTRY—GEOLOGY.

First Degree.

Intuitive lessons on common Metals. Stone used in building. Each pupil should collect specimens.

Teach children to observe the following bodies in relation to their most apparent characteristics, both physical and chemical, without employing apparatus: table salt, sugar, sand, clay, soda, potash, marble, chalk, lime, coal, sulphur, illuminating gas, ammonia.

Make collections of above.

Make solutions and mixtures.

N.B.—This course calls for no extended verbal explanation; it suffices that the pupils be exercised to know these bodies and to name them. Sense training here comes in largely.

Second Year.

Cause pupils to examine some acids, some bases, some neutral bodies; vinegar, sulphuric acid, hydrochloric acid, nitric acid, ammonia, water, &c.

Experiments with paper and solutions of litmus. See the relation these bodies bear to those of the first degree.

Prepare nitrogen, hydrogen, oxygen, carbonic anhydride. Compare these bodies. General ideas of simple and compound bodies.

Show the action of the water's erosion on rocks. Show in the environs of Brussels where recent, quaternary (flinty and other deposits), tertiary (in Brussels, Lacken, Ypres) are found.

Call attention to the strata or beds, the differences of colour and composition of the rocks composing them, the flint, sandstone, calcareous stone which they contain; the characteristic fossils (pecten, ostrea, nummulites, shark's teeth, &c.).

Make collections of rocks and fossils.

Cause geological sections to be made, by placing the rocks and fossils on leaves of paper or pasteboard in the position they should occupy.

N.B.—This programme calls for no definition, nor for any special theorizing.

Third Year.

Repeat the chemical experiments of the second degree.

Add chlorine, hydrochloric acid, ammonia, &c.

Frequently illustrate the indestructibility of matter.

In the sixth year summarize chemical nomenclature, &c.

Perform some simple experiments to illustrate the atomic theory.

Graphite, anthracite, coal, lignite, peat, bitumen, diamond, silica and silicates, &c.

Cause these bodies to be studied, as also ores of ordinary metals.

Collect specimens, show some crystalline forms.

Produce simple crystallizations.

In holiday walks cause pupils to notice secondary and primary formations. Visit the quarries of Quenast, Ecaussines, or Soignies, the palæontological and geological galleries of the Museum of Brussels, a coal mine (sixth year). Study geological

sections (second degree), exercise the pupils in interpreting the geological map of the country.

N.B. In the last year of study, a general review is made. Clearly state the bearing of geological periods. Insist on the permanence of the causes which modify the disposition and composition of the strata.

V. TECHNOLOGY.

First Degree.

Properties and names of textile materials in the raw state, and then in spun and woven (flax, cotton, hemp, jute, wool, silk). Show the plants and animals that produce them.

Each pupil makes a collection of samples.

Wood, in planks and also varnished.

The trees are shown.

Brick-making—a brick-field is visited.

N.B.—No verbal explanation of the manufacture of threads and tissues is given. It is enough to exercise the pupils to discriminate by means of their senses. In the same way with the woods.

Second Degree.

Visit a pottery—glass-house, gas-works, lime-kiln.

Collection of samples of raw materials and products.

Third Degree.

Spinning, weaving, brewery, tan-yard, sugar factory, foundry, collection of samples.

Higher course: metallurgy, printing, lithography, engraving, &c., photography.

General observation:—This instruction is given chiefly by means of visits to various works. Pictorial representations are made use of only after the things themselves have been seen.

VI. PHYSICS.

First Degree.

Distinction of solids, liquids, gases. Change of one state into another.

Bodies which float, and those which do not.

Similar experiments with mercury, alcohol, &c. Weigh equal volumes of these bodies, and of the liquids in which they are immersed.

Inflate fire-balloons, gas-balloons. Note the similarity of these ascensions with those of certain bodies in liquids.

Distinguish bodies into luminous, illuminated, opaque, translucent, transparent. Of shadow. White light analysed and reconstituted: solar spectrum. (Sense training.) Mirrors, plane, concave, and convex lenses. With these instruments are shown, without entering into details, the chief phenomena of optics.

Produce echoes. Experiments with the electrical machine, Leyden jar, without explanations, only sensations noticed. Call these "Electrical Phenomena."

The properties of magnets and the magnetic needle. Draw attention to the direction of the winds, clouds, fogs, rain, snow, hoar-frost, lightning, whenever these occur.

Explain them by simple experiments.

Show that heat expands bodies. Centigrade thermometer.

N.B.—This programme requires no definitions. Only observation is required of the phenomena themselves and by means of experiment.

Second Degree.

Cause the pupils to notice certain phenomena due to atmospheric pressure; by means of experiments (Torricellian vacuum, bladder, &c.) conclude, by induction, the existence of such pressure. Barometer, pump, air-pump.

Show by experiment the physical properties of liquids.

Equality of pressure. Hydraulic jets. Level in communicating vessels. Water level; spirit-level. Hydrostatic balance (Archimedes' experiment). Calculations from experiments.

Thermometers. Make one. Different scales; compare them. Change of one scale into another. Applications of dilatation: rails, fire-bars, &c.

Heating, chimneys, draught.

Experiments to determine the velocity of sound.

Echoes: monosyllabic and polysyllabic.

Musical instruments to be examined and analysed.

Exhibit the phenomena of reflection, refraction, dispersion of light.

Declination of the needle.

Electricity by friction. Electrophorus, electrometer, condenser, Leyden jar.

Observation and simple explanation of ordinary meteorological phenomena when these are manifested.

N.B.—Same observation as for first degree.

Third Degree.

Hydraulic press.

Fountains, artesian wells.

Determination of the specific weight of some solid bodies or liquids with the aid of areometer, hydrometer, &c.

Metallic barometers. Siphons. Tantalus' cup. Hero's fountain.

Sound is not developed in vacuo: experiments.

Sonorous vibrations. Diapason.

Metallic thermometer, differential thermometer, maximum and minimum.

Franklin's experiment.

Papin's digester.

The conductivity of bodies in regard to heat. Experiments and applications.

Simple explanation of reflection, refraction, and the dispersion of light.

Camera lucida, camera obscura. Lighthouses, magic lanterns.

Rainbow. Mirage.

Mariner's compass.

Lightning conductor.

Electric pile: effect.

Electro-magnets.

Telegraph.

Telephone, phonograph, microphone, &c.

General properties of matter. Experiments, applications.

Phenomena of capillarity.

Higher Divisions.—Principles of physics established by experiments and then formulated.

Insist upon the difference between phenomena and their laws. Abstract character of the latter.

N.B.—In each degree the teacher causes sketches to be made of the apparatus employed, provided this involves no very great difficulty.

VII. MECHANICS.

First Degree.

Show, name, and make pupils handle the principal tools in ordinary trades—masons', carpenters', blacksmiths', shoemakers', tailors', &c. ; agricultural implements used in gardening, &c.

Show, name, and make pupils examine ordinary vehicles, carts, carriages, boats, &c.

Make children find the motive power. Cause the direction of the movement to be determined.

N.B.—This programme calls for no definition. The children look at the actual thing, not at a model.

Second Degree.

Experiments with a rigid bar serving as a lever. Fulcrum, power, resistance, arm of the lever. Make pupils find levers in various instruments and tools (scissors, wheelbarrow, scales, &c.).

Experiments in equilibrium. Finding of centre of gravity, first with very thin laminae of wood or metal, having a regular or irregular form; next with geometrical solids; finally with any body whatever.

Stable, unstable, and indifferent equilibrium. Experiments with the capstan, crane, pulley, &c.

N.B.—Same observation as in former degree.

Third Degree.

Three styles of lever. Experiments to determine the relation between the arm and the power or force. Application.

Simple machines of the Second Degree, with wheel and axle, the inclined plane, the wedge; cog-wheels.

Analyze a steam-engine.

Notions of the power and the movements to be furnished by means of experiments.

Composition and decomposition of forces.

Weight: the pendulum—clocks.

Superior Class.—Insist on the unity of forces, their indestructibility. Apply intuitive teaching to the analysis of machines met with ordinarily in workshops, factories, &c.

N.B.—The teacher encourages his pupils to make little machines. He urges them to contrive apparatus and appliances.

In each Degree the teacher has the different machines which are studied sketched, so far as this is possible.

APPENDIX II.

PROGRAMME OF ELEMENTARY INSTRUCTION IN NATURAL SCIENCE—OFFICIAL PRIMARY SCHOOLS, 1880.

Natural Science Teaching in the Primary Normal School of Brussels.

First Degree.

Elementary Notions of Natural Sciences.

I. *Man.*— Principal external portions: first ideas regarding the organs of sense. Hygienic advice: cleanliness of body and dress.

II. *Animals.*—1. Principal mammalia, domestic and wild. Certain fishes and birds. Essential traits of the three classes; names, external distinctive characteristics of each individual. 2. Familiar talks on the habits of animals, and the services they render to man.

III. *Plants.*—Make children notice the essential organs of each plant—root, stem, leaf, flower, fruit, seed. 2. The most important plants (trees and herbaceous plants) found in gardens. Some poisonous plants widely diffused; names, characteristics most easily seen. 3. Prepare a herbarium of these plants, their parts.

IV. *Minerals.*—Most ordinary minerals of the country. Common metals: names, physical traits. Make a collection.

V. 1. The three states of bodies. 2. Colours: decomposition of white light; practical exercises. 3. Clock: external parts; reading time.

Second Degree.

I. *Man.*—Summary description of the skeleton. First notions on the chief functions of life: digestion, circulation, respiration. Hygienic counsels arising from these notions.

II. *Animals.*—1. Make pupils notice some typical animals of the four branches: vertebrata, articulata, mollusca, and zoophytes. 2. Make the type well known by descriptions, and the division of vertebrata into classes: mammalia, birds, reptiles, batrachians, fishes. 3. Study of a type in each of the following: mammalia, quadrumana, carnivora, insectivora, rodents, pachyderms, ruminants, cetaceans.

Birds: raptores, passeres, scansores, gallinaceæ, grallæ, palmipedes.

Study of a type in each of the following classes: reptiles, batrachians, fishes.

N.B.—The teacher will be careful to show the characteristics of each group in relief, and to name some useful or injurious animal in each class.

III. *Plants.*—1. Study in each chosen types, showing the principal organs of the plant: root, stem, bud, leaf, flower, fruit. 2. Study a typical specimen in each of the following: dicotyledons, crucifereæ, malvaceæ, linaceæ, papilionaceæ, rosaceæ, umbelliferæ, compositæ, solanaceæ, urticaceæ, cupuliferæ.

Monocotyledons. Gramineæ.

Acotyledons. Fungi.

N.B.—The teacher will be careful to show the essential characteristics of each in relief, and to name some useful or injurious plant of each kind.

3. Prepare a herbarium.

IV. *Minerals.*—Notions on sand, clay, chalk, sandstone, schist, slate, coal, peat, sulphur, petroleum, table-salt, ordinary metals.

Make a collection.

V. *Notions on Industries.*—Make children notice :—1. Textile substances in raw state, in threads, and tissues; linen, hemp, cotton, woollen goods, silk. 2. Building material: wood, stone, brick, lime, cement. If possible, visit a quarry, a brick-yard, a limekiln.

Make a collection.

VI. *Notions of Physics.*

1. Weight. Vertical, horizontal. Plumb-line, spirit-level.
2. Heat and the three states of matter. Experiments: fusion, solution, ebullition, vaporisation, evaporation, condensation, congelation.
3. Existence of the atmosphere.
4. Simple explanation of winds, fogs, clouds, rain, and snow.

5. Experiments with levers and the principal instruments connected therewith.

Third Degree.

I. Man: Repetition of description of skeleton. Notions more fully developed on the principal functions of life: digestion, circulation, respiration. Nervous system; organs of the senses; hygienic hints.

II. 1. Animals: Rapid rehearsal of the characters of the zoological groups studied in the middle course. Synoptical table of the classification of the animals already known.

2. Invertebrata: study of types of the following groups: insects (their various changes), arachnida, crustacea, vermes, mollusca and zoophytes.

3. Conversations on mammals destructive of insects; on birds, reptiles, batrachians that are useful to agriculture.

III. 1. Show (*a*) the phenomena of germination in the bean; wheat. (*b*) The different phases of plant-life.

2. Study of a type of each of the orders enumerated below: if possible a new type will be chosen for the orders already known.

Dicotyledons: cruciferæ, malvaceæ, linaceæ, papilionaceæ, rosaceæ, umbelliferæ, compositæ, labiatæ, solanaceæ, urticaceæ, cupuliferæ, coniferæ.

Monocotyledons: liliaceæ, gramineæ.

Acotyledones, filices, fungi.

N.B.—It will be very important to bring out prominently the essential characteristics of the order, and to exhibit and explain some useful plants in each group.

3. An herbarium to be prepared.

IV. Minerals: mining work. Some important Belgian ores Collection.

V. Notions on some industries:

1. Brewing, sugar making, tanning.
2. Paper and printing.
3. Exhibit products of local industry. Collect specimens.

VI. Notions on physics.

1. On some general properties of bodies: divisibility, porosity, compressibility, elasticity.
2. Mass, weight, centre of gravity.
3. Lever, pulley, wheel.

4. Elementary notions on equilibrium in liquids, communicating vessels, level, jets.
5. Air, its physical properties.
6. Atmospheric pressure, barometer, pump, air-pump.
7. Sound, echo.
8. First notions on heat, dilatation, thermometer.
9. Evaporation, fog, cloud, rain, snow, hail, dew.
10. First notions on light. Solar spectrum, rainbow, colours.
11. Magnetised needle, the compass.
12. Notions on static electricity which are necessary to explain the cause of thunder or lightning; lightning-conductors; precautions to be taken during a storm.

OPTIONAL BRANCH.

Third Degree.

Notions of Agriculture.

A.—The soil.
  1. Arable layer; the subsoil.
  2. Varieties of soil; their properties: clayey soils, sandy soils, chalky soils.

B.—Subsoiling lands; use of drainage.

C.—Tilling of the soil.
  1. Why it must be tilled.
  2. Effects of tillage.
  3. Instruments used in tillage.

D.—1. Weeding and cleansing soil, reasons for.
  2. Harrowing.
  3. Hoeing, tools used in.

E.—Manures.
  1. Their uses.
  2. Farm-manure, its value, its preparation and preservation.
  3. Its insufficiency.

F.—On the choice of grain for sowing.

First elements of arboriculture.

Buds, cuttings, grafts. On training of the pear-tree in pyramidal and fan-form.

The following paper by M. V. J. Germain, Director-General of Primary Education in Belgium, was then read by M. Couvreur.

ON THE TEACHING OF DOMESTIC ECONOMY AND NEEDLEWORK.

By V. J. GERMAIN,
Director-General of Primary Education in Belgium.

THE most distinguished authorities of our time on educational matters have laid down this principle, that primary education has for its object—1st, to train concordantly the physical, intellectual, and moral faculties which, in children, constitute human nature and dignity; 2nd, to prepare children not for one profession exclusively, by special training, but for all professions (though within restricted limits, it is true) by a general education which can serve as a basis for any ultimate development.

It is a great mistake to turn primary schools into apprenticeship schools for preparing children for various trades; it is ignoring the want of a previous training of the faculties, before applying them to manual work, to production.

But if the task of preparing children for special trades cannot be made incumbent on schools, care should be taken that the teaching should embrace, together with the ordinary branches of study, those branches that can assist in forming clever artisans, intelligent agriculturists, and provident and thrifty housekeepers, i.e., the rudiments of natural sciences and agriculture, sanitation, domestic economy, and needlework (in girls' schools), geometrical figures and drawing, and the making of paper, millboard and wood objects (in boys' schools).

Besides their advantages from a practical point of view, these various branches of study have a highly educational value.

1. They promote attention and methodical observation, impress on the mind accurate and clear notions, affording to intellectual activity the elements upon which it will have to be displayed.

2. They offer numerous opportunities to accustom the

mind to perform with precision its proper functions, such as analysing, comparing, judging, abstracting, generalising, classifying.

3. They awaken and develop a taste for the beautiful.

4. They promote a taste for order and for work, and facilitate the intelligent exercise of a number of professions.

Our object is more especially to examine in this paper the principles upon which the teaching of domestic economy and needlework may properly be organised in girls' schools.

DOMESTIC ECONOMY.

The development now given to the education and training of women has for its special object to prepare them for their domestic duties. After what may be correctly described as their moral obligations, the most important duties of women are to preserve their children's health; to keep their house with cleanliness, order, and economy; to make their home attractive, and, as Madame Henry Gréville says, to provide for those around them, at the smallest possible cost, the greatest amount of material and mental comfort.

"Every wise woman buildeth her house; but the foolish plucketh it with her own hands."

This has become proverbial, and it is often said that the wives cause the prosperity or the ruin of families. The schools must train orderly, saving women, who will know the value of thrift—women who will be the cause of the prosperity and never of the ruin of their families—women who may be the worthy companions of their husbands—women like the virtuous woman in the Scripture, whose price is far above rubies.

Training-schools are the foundation of primary schools. We have therefore to examine, in the first place, what is the destination of training-schools for female teachers, from the point of view of domestic economy:

1st. *The interior organisation of the school must be for the students a practical school of domestic economy.*

2nd. *A regular course of lectures on domestic economy must be given on the principle of observation and practical experiments.*

First, the whole house must be a model of cleanliness, order, economy, simplicity. Thus, the head-mistress, teachers, and pupils must avoid studied elegance; they must be neatly dressed, but without such finery as would be out of keeping with the duties of teachers. The directress must often remind them that simplicity is the ideal of the beautiful. She should not forget that practice only makes good housewives. The students must mend their own clothes, make their beds, set their things to rights; they should be made to lay the cloth in the dining-hall, and attend in turns to the furniture, the library, and the collections. Once a week, on the Thursday afternoon, a certain number of students should, under the direction of the stewardess, and with the help of the cook, prepare the principal meal; on such days dinner should be served towards the evening.

The students must often be taught the judicious use of money. In families, it is generally the husband who earns the money, and the wife who superintends the expenses; let her exercise a wise discretion; if the money be well spent, the family prospers; if not, it declines. The first care of a housewife should be to keep an accurate account of her expenses. In the first place, she must prepare a budget. To make purchases first, and then to think how the money shall be obtained in order to pay, is the first step on the road to ruin. Let, therefore, the training-schools teach a simple and easy system of book-keeping, which will enable housewives to see at once and accurately the assets and liabilities of the family; let the students be taught not to incur unnecessary expenses, and the danger of buying on credit. They must also be taught how, by saving money, a capital is formed which quickly increases; this can be done by practice, each student having an account in the savings-bank. They should be compelled to keep their accounts in a regular manner, the money given them

by their parents to pay for the school expenses, the washing of their clothes, and other sundry disbursements, the Government and Provincial "purses," or scholarships, constitute their *assets ;* on the other hand, they should carefully note all the payments they make.

It may be hoped that, when they will become teachers, they will preserve the good habits they formed when at the training-school. Having thus been educated, they will help in training young girls capable of keeping an establishment with order, regularity, and comfort, thus ensuring domestic peace and happiness.

Second. The programme of the regular course of domestic economy, to be undergone in training-schools for female teachers in Belgium, has been settled as follows by ministerial decree of the 18th of July, 1881 :—

1. On the qualities of a good housewife.
2. On the conditions requisite to make dwellings healthy. Ventilation. Cleanliness.
3. Furniture ; how to keep it in repair. Kitchen utensils ; their material, how to keep them in good condition.
4. Heating and lighting. Practical advice.
5. Laundry. Use of soap ; on the use of liquid chlorides. Scouring. On the uses and danger of petroleum, naphtha, alcohol, oxalic acid.
6. On the keeping in repair of linen, bedding, and clothes.
7. Practical advice on food. Qualities of various kinds of food ; how to preserve food : bread, potatoes, meat, fish, eggs, cheese, fat, vegetables, fruits, groceries.
8. General notions of culinary preparations. Waiting at table.
9. Drinks : water, milk, beer, wine, coffee.
10. Drawing up of detailed estimate for furnishing a female teacher's house.
11. Young ladies' dress.
12. Accounts of an establishment. Practical exercises.
13. Kitchen gardening.

Note.—The necessary measures shall be taken in order that during the first year student-teachers may be practically instructed in the service of the table, the keeping in order of bedrooms, and the most important culinary preparations. The directress shall be very careful in preventing the practical education of student-teachers from being turned into the performance of menial duties for the benefit of the institution.

It is comparatively easy to draw up a good programme; but there is sometimes a wide difference between the spirit of the regulations and their practical application.

What are the fundamental rules to be observed by the teachers of domestic economy?

In the first place, domestic economy must be taught in training and primary schools in the same manner as natural sciences, viz., on the principle of observation and practical experiments.

It has been proved that purely oral lessons give but indifferent results; the teaching of domestic economy must be decidedly clear and practical. A few examples will explain our idea.

It is indispensable that a housewife should be made to understand that she ought to take every precaution against sewer-gas. A simple dissertation on this subject is insufficient. By means of a special model it should be explained how the house drains are connected with the town sewers; the working of the air-valves, their position and use, should be illustrated by means of models; models of sinks and water-closets should be shown, and their mechanism explained. As to disinfectants, the students should be taught to use them practically, and in the required proportions.

The system of petroleum lamps, for example, should be described with great care, with the help of a special model showing all the details. The teacher will have to give the reasons for which the regular and proper trimming of such lamps is indispensable, and to explain the various improvements introduced in petroleum lamps to prevent explosions.

It will not be sufficient, when dealing with naphtha, to say that it is highly inflammable ; this fact must be demonstrated by an experiment.

With regard to copper vessels, it will not suffice to say that they are dangerous on account of the presence of verdigris ; the formation of this poisonous substance must be illustrated by experiments.

Again, when speaking of the advantages of filters, it should be explained how filters are made, and a few experiments should follow to show the absorbent and antiseptic properties of charcoal.

As a consequence, it is indispensable to establish in all training schools collections destined to illustrate the various branches of study. Experiments should be more often resorted to, and the students should be called upon to form for themselves collections relating to the various subjects taught them.

In the Belgian section (Health Exhibition) a very exhaustive collection is to be found of the different articles and models which compose a museum of domestic economy for training schools. The objects in this museum have been contributed by the Belgian training schools ; the classification adopted is that of the above-mentioned programme.

Another remark I have to make on training schools is that the Belgian Government has found it necessary to include among the subjects to be taught in connection with domestic economy the following subject—"Kitchen Gardening." In order to teach properly this kind of gardening, training schools for female teachers should have a garden for growing fruits and vegetables, and laid out according to the most approved methods, where the future teachers may have practical lessons during recreation time and on holidays.

Kitchen gardening should be taught rather to female student-teachers than to male teachers, to young girls rather than to young men, because it is generally the wife who attends to the kitchen garden. An eminent French

agriculturist, M. P. Joigneaux, says on this subject:—"It cannot be believed how quickly horticultural knowledge is assimilated by women. For the very reason that they practise gardening indifferently, and are fully alive to its advantages, they would always be well disposed to receive favourably any advice given to them; and it would be seen that they would make more progress in a year or two than the best intentioned men in five or six years."

What must be taught of domestic economy in primary schools?

In my opinion the teaching carried on by means of practical lessons, of lectures and dictations, should include the most important subjects of the programme of the training schools, and particularly all that refers to the cleanliness of dwellings, the keeping in good order of furniture, the laundry, and the preparation of ordinary dishes. As in the training schools, the teacher should illustrate her lessons by models, and give to her teaching the most practical character possible. Care should be taken that the pupils form collections of samples of various textiles, of colonial produce, of substances used for laundry purposes, for the cleaning of clothes, &c., at the same time taking all necessary precautions to guard against all possible danger.

After leaving the primary schools, it is desirable that young girls belonging to the working classes should attend the "écoles ménagères" (housekeeping schools), the lessons in which are organised on the same plan as the lectures on domestic economy in training-schools.

In these "écoles ménagères" sewing and dress-cutting, washing and ironing, housekeeping and cooking are practically taught.

Let us sincerely hope that all these institutions may prove as completely adapted for their destination as can be wished, and may educate young girls who will know how to make a home pleasant, cheerful, and decent. "The 'école ménagère,'" says Madame Hippolyte Meunier, "may and should teach every young girl that her future duty will be to make her home happy, agreeable, and pure; to orna-

ment it with a few flowers, to decorate it; and to make it attractive by allowing full play to the beneficent rays of the light-giving and air-purifying sun; by increasing, through her constant wisdom, the resources of comfort, and by displaying the treasures of her mind and heart."

Needlework.

The following are the various kinds of needlework the teaching of which has been made compulsory in the Belgian primary schools since the year 1877:—

First or Elementary Grade:

1. Knitting a *band* or *garter* (two needles), various stitches—plain stitch; seam-stitch; ribs; intakes; missing and picking up stitches.
2. Knitting circular objects (four needles)—mittens.
3. Socks, study of the proportions; mounting and knitting.

Second Grade:

Going over preceding grade.

1. Knitting stockings; proportions of the various parts; drawing of a stocking and its various proportionate parts; mounting and knitting; mode of measuring the stocking whilst it is being made; mode of strengthening heel.
2. Marking on canvas: alphabets and ciphers.
3. Rudiments of sewing: running-stitch, side-stitch, stitching, sewing, seaming, hemming, double-seaming, selvedge seams, folded seams.
4. Making of easy and simple sewn objects: towels, napkins, pocket-handkerchiefs, aprons, under-clothing, mending, and patching.

Third Grade:

Going over preceding grade.

1. Knitting petticoats, vests, mittens, gloves.
2. Marking linen: alphabets and ciphers.
3. Stitching, puckering, button-holes, eyelets.

4. Mending clothes, darning stockings, patching clothes and linen, fine darning of table and ordinary linen.
5. Making and cutting clothing, and particularly underclothing.

Note:—Fancy work, crochet, embroidery, tapestry, and net-work shall only be taught to pupils perfectly familiar with all kinds of useful work.

Notwithstanding the progress realised in recent years, many schools have remained below the mark with regard to the teaching of needlework and dress-cutting.

The want of method is the principal cause of their inferiority. A number of teachers have adopted the individual method, that is to say, that the pupils are engaged during the same class on works of various kinds; sometimes, however, they are engaged on the same kind of work; but the teacher does not endeavour to obtain simultaneous exercises; she goes from one pupil to another, and gives advice to each one individually. In order to maintain discipline, reading or singing goes on whilst needlework is being done; it is thus forgotten that full and undivided attention should be given to the study of needlework, as well as to any other branch of study.

To ensure success the teacher must apply to the lessons in needlework the methodical principles to which we think it our duty here to call attention.

1. All needlework indispensable in every household should be taught (in schools), and the task of the teachers is not accomplished until all the pupils know how to cut and make bed and ordinary clothes: sheets, pillow-cases, aprons, underclothing, children's dresses, men's shirts, boys' vests and knickerbockers, dressing-gowns, &c.

Fancy work may be taught only to pupils perfectly familiar with all kinds of useful work.

2. The lessons to be given on the simultaneous method.

3. Every lesson to begin with a short survey of the preceding lesson.

4. Every new kind of work shall be the object of an oral lesson including, if need be: (*a*) a study of the various

detailed parts of the object to be made; (*b*) the execution or explanation of the work by various intuitive processes (after Frobel's system, canvas frame, and diagrams on the black-board, slate, and copy-books); (*c*) questions by means of which the teacher shall invite various remarks, draw comparisons between various objects, and ascertain that the pupils have understood the subject.

5. After the oral, demonstrative, and intuitive lesson comes the application, or, properly speaking, the practical lesson, during which the teacher shall allow the pupils considerable freedom and initiative.

6. Accuracy in the work is absolutely necessary. Various methods may be applied. In certain cases the mutual system may be resorted to. Thus, for example, a pupil having made a hem on the canvas-frame, the others, after exchanging their work, examine, each in her own special department, whether in the work submitted to them the stitches are properly and regularly made.

7. In the higher division, pupils shall, from time to time, write essays accompanied by designs; they will thus compose for their own private use a guide to dress-cutting and making.

8. Care should be taken that the pupils formed a collection of the various objects they have made—garters, mittens, stockings, &c.—for the children will not fail to try and increase their collections.

The application of intuitive processes requires great attention. The first condition to be fulfilled before undertaking work of any kind is to understand it well in its details. A teacher gifted with an ingenious disposition will be able to invent intuitive processes of her own. For knitted work, for instance, she will prepare objects worked with very stout yarn, and have them pasted on pieces of cardboard which she will use for explaining difficult stitches.

The canvas-frame is indispensable for the intuitive teaching of sewing, marking, tapestry, stocking-darning.

Large diagrams hung on the wall for studying dress-

cutting will be found useful to teachers who are not proficient in the art of drawing on the black-board.

Too much stress could not be laid on the usefulness of drawing as a help to the study of needlework. With the help of diagrams the intuitive study of all kinds of work becomes possible. The following, by way of example, are a few of the figures to be drawn on the black-board :—

Knitting.—Plain stitches, plain and seam stitches, drawing of a sock, drawing of the various parts of a stocking, drawing of darning stitches, drawing of picking-up stitches, drawing of marking stitches.

Sewing.—Diagrams representing running-stitch, stitching, side-stitch, hem, seam, button-hole stitching; the mode of joining pieces, patching, and mending; diagrams showing how to cut a piece of cloth economically.

The training schools must, in the first place, enable their students to realise the programme set for the popular schools. The only means of securing this result is to apply the same method to the lessons taught both in the training and in the primary schools.

It is hardly necessary to point out that the teaching of needlework, as applied to student-teachers, is more comprehensive than the teaching in primary schools; student-teachers are taught more fully dress-cutting and making; they are taught to use the sewing machine, as also certain fancy work; they undergo a special course of training; but all this teaching should be carried on in the same methodical spirit.

In order to hasten the application of the above-mentioned principles, temporary training classes should be established for the teachers of primary and training schools.

The Belgian Section (Health Exhibition) comprises two methodical exhibitions of needlework, that of training schools, and that of primary schools. The works and patterns are classified in the order adopted in the official programme.

In Belgium, the Communal administration supplies gra-

tuitously the children of the poor with the necessary materials for needlework.

The following is the programme adopted for the training schools :

First Year.

I. *Stocking-Knitting.*—Relative proportions of various parts, diagram representing stocking and proportionate parts, mounting and knitting, measuring stocking whilst it is being made, mode of strengthening heel.

II. *Marking.*—Marking-stitch on canvas, alphabet and ciphers, marking-stitch on linen.

III. Rudiments of sewing: various stitches, hemming, seaming, stitching, puckering, button-holes, eyelets. Cutting and making: sheets and pillow-cases, aprons, and under-clothing.

IV. Mending clothes and linen.

V. Fancy work, tapestry, crochet.

Second Year.

I. *Knitting.*—Petticoats, vests, mittens, gloves.

II. *Sewing.*—Cutting and making underclothing, night-gowns, flannel vests, children's dresses, men's shirts.

III. Darning and mending stockings, fine darning (table and ordinary linen).

IV. Fancy work: crochet, embroidered initials, &c.

Third Year.

I. *Sewing.*—Cutting and making men's shirts, boys' vests and knickerbockers, young girls' dressing-gowns, and dresses.

II. How to use the sewing-machine.

III. Fancy work.

IV. *The teaching of Needlework in Primary Schools.*

a. Knowledge of methodology to be acquired by needlework teachers.

b. Programme of Primary Schools (20 July 1880).

c. Necessity of simultaneous method for teaching needlework as well as other branches.

d. Account of the intuitive methods to which teachers must resort.

e. Application of drawing to the teaching of needlework, and particularly to dress and linen cutting.

f. On the system of teaching, explanations, questions.

g. Didactic exercises.

In primary schools four hours weekly are devoted to needlework; in training schools the time devoted to needlework is four hours weekly during the first and second years, and three hours weekly during the third year.

The CHAIRMAN (Mr. St. John Ackers) said that the Conference was very much indebted to gentlemen from different countries, who gave their various experiences, and it enabled the Conference to be what it professed to be, an International Conference on Education. He had very great pleasure in moving a very hearty vote of thanks to the foreign gentlemen who had written the papers.

The motion was carried by acclamation, and briefly responded to by Mons. COUVREUR and Professor GINER DE LOS RIOS.

TEACHING OF AGRICULTURE.

THURSDAY, AUGUST 7, 10 A.M.

Chairman: Mr. B. ST. JOHN ACKERS.

THE TEACHING OF AGRICULTURE.

By Earl FORTESCUE.

I CONCLUDE that I have been invited to read this paper because, for more than forty years, I have been spending money and labour in the promotion of education in all classes,—the lower, the higher, and the middle, but for a long time more especially in the middle class.

The teaching of agriculture may be considered in several points of view as regards—1, the owner of the land; 2, the occupier of the land; 3, the worker on the land. Sometimes (as in the case of the small freeholder) all three, and very frequently two, of these characters are combined in the same person. A landlord, of course, will be able to promote his own and the public interest better if he knows something of the principles and practice of agriculture: still, if he does not, his estate may be fairly well-managed for him by an honest and competent land agent,—so the farm labourer will do his work the better for knowing the reasons for the different operations which he performs for his employer: but his ignorance of the rationale of those operations, if he be fully capable of performing them, need not prevent their being carried on with success, if judiciously

arranged and carefully superintended. But if the occupier of the land does not understand his business, which is becoming year by year more difficult and complicated, demanding not only more varied knowledge, but more judgment, to render him capable of meeting the constantly changing requirements of its different branches, he cannot be expected to make it pay.

Far the greater part of the United Kingdom is still unquestionably occupied by renting farmers. I find in the last census the number of male and female farmers and graziers in England and Wales returned at about 224,000, and of the sons, nephews, and other male relatives living with them at some 75,000; no account being kept of female relatives living on any farm, though many of them notoriously take an active share in particular kinds of farm work. As there are besides about 25,000 returned as male and female milksellers and dairymen (a certain number of whom would fairly count as tenant-farmers), it is evident that the tenant-farmers of England and Wales, with the members of their families engaged in farming, must amount to some 300,000, employing about 870,000 shepherds, farm servants, labourers, &c., of whom about 40,000 are females. According to the Official Return of 1880 about 70 per cent. occupy 50 acres and under, about 12 per cent. from 50 to 100, about 14 per cent. from 100 to 300, about 3 per cent. from 300 to 500, about 1 per cent. from 500 upwards I may add, that out of a total of over 37½ millions of acres the land under the head of "cultivated" is returned at over 27½ millions, of which over 13½ millions is permanent pasture; and further, that the body of tenant-farmers, though of late somewhat diminished in number, and alas! most of them sadly impoverished, still considerably outnumbers any other body of employers engaged in any one other distinct business, trade, or manufacture. Moreover, their skill and industry, however admittedly susceptible of improvement, has now for a century produced this undeniable result,—that in proportion to the natural advantages of soil and climate, the average farm produce

per acre of England has exceeded that of most of the countries of northern Europe; while our breeds of horses and stock generally have obtained a world-wide celebrity.

It is the education of these farmers' sons that I propose to consider, with a view to their hereafter profitably occupying farms; or, in some cases, qualifying themselves for farm bailiffs, of whom a certain number have been always wanted for the home farms, which, for several generations, most English country gentlemen have had in their own occupation. A number more are now, alas! wanted, I hope only temporarily, on the too numerous farms which during the last seven *lean* years so many unfortunate landowners have had thrown on their hands—farms, which all the landowners able in any way to keep in cultivation have done wisely in cultivating; though a certain number, owing much oftener to their owner's inability than will, have been allowed to become seed beds of weeds for their neighbours, and causes of pauperism to the labourers formerly employed upon them.

Up to the age of eleven or twelve there is, and need be, little difference in the education of farmers' sons, whatever sized farms their fathers occupy. They would generally go to elementary schools, except, of course, the sons of the very few very large farmers. These last would from their childhood still mostly be sent to some exclusive middle-class school, where higher payment is demanded for its exclusiveness rather than for any superiority in the instruction given over that in the greatly improved elementary schools of the present day, whose enormously enhanced cost, however, falls generally more on the ratepayer and taxpayer than the parent. I cannot myself look with favour on special farming schools for boys intended for farming, whether as employers or employees: nor can I bring myself to believe in any state-created, state-supported, and state-inspected schools of the kind. I agree with Mr. Baily Denton, Mr. Wilkinson, and Mr. Jenkins in some, but by no means all, of their views about elementary schools. Much of the higher mathematics and literature taught to their upper classes might, I believe, be advantageously re-

placed by more useful subjects, and most of the grammar in all those schools. I doubt, however, the real infusion of the principles of agriculture into such very young minds by the agricultural reading-books suggested for rural schools; and I much fear jobbery and favouritism in their getting-up and circulation. That a lesson on agriculture or on almost anything may be made interesting to children by some teachers I do not question; but I do their being of adequate practical benefit when given by average school-masters. Then as to a general garden for the school, and separate garden plots for some of the boys—I remember some thirty years since hearing of both having been successfully worked somewhere, and proposing both (with my father's consent) for our village school, established nearly a century ago. I found the parents sent their children (mostly from long distances) to school as tidy as they could, and did not want them to do garden-work there. Such gardens would probably answer well or ill according to the circumstances of the place and the spirit with which the plan is taken up. But to establish such a system of reading and gardening all over the country would certainly lead to immense expense, with, I fear, much immediate sham work, and the danger of future jobbery and stagnation. In ever-advancing science, work and views, advanced in their day, soon become obsolete and practically retrograde. Comparatively little is as yet known with certainty about the art of agriculture. The principles of mechanics, physiology, and chemistry have indeed been ascertained, but how much of these is there time for teaching in the short school life at an elementary school? The great thing is to teach children how to think and how to learn.

I have repeatedly protested against preparing for Standards VI. and VII. in every elementary school, because unsound in principle and wasteful of the teachers' time and labour; as also against the recent anomalous so-called "advanced elementary," which Bishop Temple (strongly deprecating them) well describes as "non-elementary elementary" schools. But I have long held with the Endowed Schools

Commissioners in their admirable and exhaustive Report on Education that there was room for a set of schools between the elementary and the secondary, not carrying on instruction as far or into such high subjects as the latter do. In such schools for these poorer scholars, technical instruction in the nature of apprenticeship might perhaps be usefully given in various practical arts and handicrafts, which in rural districts would of course have special regard to farm work; thus developing manual dexterity somewhat earlier at the sacrifice of some book-learning. Parents of ordinary children, who can afford it, should pay for their more advanced instruction in secondary schools, which children of extraordinary merit should be sent up to from the elementary schools by scholarships.

I think the advantages of educating together at the same county or grammar schools middle-class boys, sons of parents engaged in different professions and trades, and themselves intended for the same variety of occupations, greatly preponderate over the advantages of separate schools for the special instruction of young boys to fit them for special employments. It is to our new county schools and improved and revived grammar schools, that I think we should look for the education of all but the small farmers' sons, after leaving the elementary schools of their childhood. I should be glad, however, to hear of some such arrangements being made in more of these intermediate schools, as I gather have been made at Cranleigh, for the boys there intended for farmers, to see something of the practical working, and perhaps take some part too in the working, of some really well-managed farm near the school, while attending a limited number of lectures, which, before long I hope to find given in such schools, on the first principles, I will not say of agriculture, but rather of chemistry, physiology and mechanics as applied to agriculture. It has been long thought by some that in boarding schools for the sons of parents, to whom expense is so very important a consideration, part of the time indispensably required for relaxation from hard brain work, instead of

being as at present almost monopolized by games, should be devoted to the acquirement of dexterity in different kinds of hand-work specially suited to the boys' different inclinations, or to their intended future occupations in life. This would be certainly, though I believe not insuperably, difficult to manage, compatibly with the unity and (so to say) solidarity of the school. Still it is so very important that no set of boys within it should be led to form a separate body, with a different character and different sympathies from the rest, in short a *clique*, that I should prefer deferring all special technical instruction until a later stage in the boy's education to running the risk of such an evil.

After quitting their intermediate schools at about sixteen, the farmers' sons intended for farming would, as a rule, in the case of all but the larger farmers, be taken home by their fathers to assist on their farms and to begin to learn their business in earnest. The establishment of a number of farming schools has been very strongly recommended: and there really would seem to be room for the tentative establishment of one somewhere for lads of sixteen or seventeen, where they would have rather less of scientific and theoretical, and rather more of practical and manual, instruction, and that on rather lower terms than at Cirencester or Downton, which are intended for older students, and afford comforts beyond what are required for younger and less wealthy ones. Its farm, of course, could not be made to pay as such, because, among other reasons, the chief object would be the teaching and training of the lads, not the getting of the largest yearly produce from the land at the cheapest rate. The terms, therefore, could not be such as to suit the purses of any but the wealthier section of tenant farmers. But I think Mr. Jenkins is right in suggesting that the Royal and the other large Agricultural Societies might usefully divert to the assistance of the practical education of farmers' sons for farming, some of the money which they now (injuriously as I believe) devote to the encouragement of so over-fatting what are miscalled breed-

ing animals, as to incapacitate some, and deteriorate many more, for breeding purposes. And this I think they could best do by giving scholarships of £40 or £50 a-year, tenable for two years at such a school, or at Cavendish or some other college. Meanwhile some of the lads, whose fathers could afford it, might go on to some such institution as Cavendish College, Cambridge, where sixteen is the usual age of entrance, and there take a degree in physiology or chemistry, which they might easily accomplish by the age of nineteen. And here I may be allowed to express a hope that a certain proficiency in the physiology of plants and animals, and in chemistry and mechanics, as applicable to agriculture, may be soon recognised by our two great Universities, not only in their local examinations, but also in the examinations of their own resident students, as a reasonable substitute for the moderate amount of Greek still insisted on in the "Previous Examinations," which have to be passed by all undergraduates.

Professor Stuart, at Cambridge, has successfully established for young men intending to be engineers, workshops in connection with my own old *alma mater*. I hope that before long that enlightened and quietly progressive university may be able to make somewhat analogous arrangements for a certain amount of practical study of agriculture there, after the attainment by the student of the requisite moderate proficiency in physiology and chemistry and mechanism as elucidated in their application to that art. If, however, the realisation of this wish be deferred for a while, there will still be open to the wealthier farmer's son a course of theoretical and practical agricultural study at Cirencester College, of which I have been for many years a shareholder, or in the recently founded Downton College, after he has taken his B.A. degree at Cavendish by nineteen, the usual age there. That is, if he does not instead give up his scientific studies, except privately in books, and either become a really working pupil of some farmer of high repute, or get practical instruction in assisting his own father on his farm—supposing that father to be fairly

skilful as well as relatively wealthy, which last he must be to afford the cost of keeping his son so long learning only instead of commencing to earn anything. It is necessary that the youth should get sooner or later, what two or three years at Cirencester or Downton alone cannot give him, viz., that practical apprenticeship, not less essential in the business of farming than in others, which practical farmers agree is indispensable for its being successfully carried on.

Mr. Jenkins, in his very able report, mentions grave doubts being entertained by eminent German authorities, as well as by himself, of the expediency of the long residence in towns spent by German students in acquiring theoretical instruction in agriculture; and prefers the system in France. The cost of the State institutions for agricultural teaching both in Germany and France is great. But in England, if efficient, their cost would be much greater—so great, indeed, that I cannot believe any government would dare to propose their extensive establishment: while the ratepayers, already unduly weighted with rates levied for Imperial purposes upon one kind of property alone, would and ought to resist such a heavy new burden strenuously. It is to be remembered that the much-coveted one years' service obtained in both countries by passing through the higher kind of educational institutions exercises with regard to them a powerful influence, by which the same classes in England, happily exempt from conscription, are quite unaffected.

It is remarkable that so many of these institutions have been established or remodelled in both countries since the Franco-German war. The £200,000,000 paid by France to Germany was the forerunner, if not the cause, of an admittedly excessive general expenditure in Germany. And in democratic republican France we know that since that payment successive ministries have spent very largely in many ways, and have added much to the national debt in time of peace. It is, therefore, full early yet to judge of the results of some of these institutions: and it would be still more premature to do so in the case of the yet more

recent Agricultural Department at South Kensington in its present development.

The managers of those State-aided institutions naturally form themselves, and express to others the most favourable opinion o their fruits. Mr. Jenkins states that in Ireland almost everything that has been done for agricultural education has been done by the government, and he gives us in full Sir P. Keenan's glowing account of the benefits conferred on agriculture by the government establishments there, and especially by that of the Glasnevin and the Munster Dairy School. I can remember visiting Glasnevin some 45 years ago, and hearing then from its managers of the great good it would do. In 1848 practical instructors were sent round the country, and in 1850 workhouse schools were widely established throughout Ireland for the same purpose. To say nothing of subsequent disapprovals both official and independent, in 1870 a Royal Commission reported that all the model agricultural schools ought to be revised and their number reduced. We have to set this against Sir P. Keenan's opinion, and to remember besides, that the Munster Dairy School is quite new; and that as it owed its origin to Canon Bagot's enthusiastic and beneficent labours, so its continued usefulness probably depends much on their continuance. But in any case I should protest against anything done legislatively, administratively, or economically, for or in that exceptional country, being adopted as a precedent for the rest of the United Kingdom.

In conclusion, I would remark, that State-aid, besides enervating those whom it teaches to look to the State for extraneous assistance instead of to co-operation with others in organising self-help, and besides demoralising those whom it teaches to ask favours for public objects, too naturally followed by similar applications for personal ones, tends, as regards institutions capable of being carried on otherwise, to cause their gradual deterioration in efficiency and public spirit; first, because government departments are inevitably imbued with the habit of routine which means stagnation, so that what was once advanced, being stationary,

soon becomes practically retrograde; and, secondly, because when first established they are usually put under zealous and able men—the right man being sought for the newly-created place; but afterwards, when for party purposes some place is wanted for a particular man, it is apt to be found for him, with more regard to his claims than his qualifications. Legislative enactments and official regulations are powerless against this tendency. The only remedy lies in raising the general standard of morality and public spirit. For, as in mechanics velocity can only be gained at the expense of power, and *vice versa*; so surely in government must every check upon abuse be an impediment to use, and every facility for use afford also facilities for abuse.

Sir THOMAS ACLAND, in proceeding to read the next paper, which had been written by his son, said that he wished to say a word with regard to the past generation. The introduction of science into agricultural practice was the work of Philip Pusey and of the late Lord Spencer. Mr. Pusey was a country gentleman and a farmer, who set his men to work at five o'clock in the morning; but he was also a profound philosopher and scholar, and was well versed in the deepest German and Greek philosophy, and he wrote admirable papers on Plato, Bacon, and Bentham. He was also one of the first founders of those institutions which had occupied so much time usefully at that Conference—the Schools of Design. The names of both Mr. Pusey and Mr. Dyce, the Artist and Musician, were dear to him (Sir Thomas) some forty years ago. He wished to make reference also to a man who was not a farmer, and who sprang from the humbler middle-class ranks of this country—one to whom the workmen of England and the North were deeply indebted for the educational work which was now going on in conjunction with co-operation. He meant Frederic Denison Maurice, the founder of the Working Mens' College. He also was

a profound student of Plato and all the philosophies of human nature which had come into the world since. He (Sir Thomas Acland) had heard so much in that room about the necessity of an almost exclusive study of material knowledge, that he ventured to state that a portion of the earliest stimulus to science was given by men who had drunk deeply into human studies.

The following paper by Mr. C. T. Acland, M.P., was then read by Sir Thomas Acland:—

THE TEACHING OF AGRICULTURE.

By CHARLES T. D. ACLAND, M.P.

I SHOULD not have felt able to justify myself in undertaking the task to which I have been kindly invited, but for the fact that I remember the beginning, and have been able to watch the growth of the movement for middle-class education, which owed its initiation and much of its subsequent development to Lord Fortescue, The Bishop of Exeter, Canon Brereton, and others, many of whom hail from my own county, Devonshire. And, as I have had no practical experience in either teaching or farming, I cannot pretend to speak as an expert either about teaching or about agriculture. I can only suggest for consideration the ideas which occur to me as an outsider who has had some opportunities for observation and reflection, and who can claim the friendship of a large number of experienced men both teachers and agriculturists, among labourers, farmers, and landowners.

The subject suggested to me was the teaching of agriculture. And the first remark that I am tempted to make is that I very much doubt whether agriculture can be taught. It certainly can be *learnt*, but it does not follow that because a man can *learn* it, either he or any other can *teach* it. Aristotle said (and he has not been proved to be wrong) that "the practical arts can be acquired and

preserved by practice alone; by building we become builders, and by playing we become musicians." And *we* may add, that by farming, we become farmers. He also said that "practical matters admit not of logical precision," and that "all science may be taught, and all teaching implies principles." These sayings of the father of inductive science seem to me to admit of a close application to the matter in hand.

It may also be remembered that the mottoes of the two principal Agricultural Societies are "Science with Practice," and "Work and Learn."

I presume that the chief points of a discussion upon the teaching of agriculture will be admitted to be when, where, and how, can the art of farming profitably be best acquired. Can anything be done by way of teaching to facilitate the acquisition? If so, who can do it? And for whom is it to be done? My object will be to endeavour to suggest useful answers to these questions.

It may be at once admitted that much may be done by qualified teachers in the way of training those who desire to be trained to learn, first, what to observe; secondly, how to observe it; and thirdly, how to record the results of their observations.

There is also no doubt that much may be done in teaching boys and girls how to do particular things which require to be done in the ordinary course of agriculture, but this teaching, if not practical and constant, will have but ephemeral results.

The question rather is, who are the proper teachers? How can they be trained? And whom are they to teach? In short, is it possible to systematise the teaching of agriculture? and if it is, what ought to be our aim?

Are we to attempt to teach all the children, or most, or any of the children in our public elementary schools how to manage farms? If not, what can we do to further the practical improvement of the agriculture of the country?

We can and we do train teachers to instruct children in practical geometry, by which they may learn how to measure

surfaces and contents; and in applied mechanics, by which they may be taught how to economise the application of force, whether it be the strength of man, or beast, or steam, or water-power, to different kinds of work.

Or the children may receive instruction about the composition of inanimate matter, and may be taught what is meant by chemical analysis, and chemical combination; or about the laws which govern heat, light, and electricity—all of which admit of practical application by means of contrivances arrived at by experience.

Or again, there are the wide fields of botany and animal physiology, with their countless facts, and their elaborate classification; and the knowledge that has been acquired of the habits of the various species which are endowed with animal or vegetable life.

To put it shortly, we can teach our children some of the broad facts of nature in her three great divisions of organic matter, inorganic matter, and the laws of the various forms of force.

But in agriculture, as in everything else, the result entirely depends upon the knowledge how to apply in practice what has been learnt; and this, it is my firm belief, can only be acquired by the learner for himself. It is here that *instruction* ceases, and *apprenticeship* begins. And if we leave out of sight the clear distinction between instruction on the one hand, and apprenticeship on the other, there is reason to fear that we may waste our efforts.

This brings us to the point where we must consider who are the persons to be taught. In my view, this is one of the most important questions. Is it, for instance, of any practical use to attempt to teach "Principles of Agriculture" to children in towns? It is no answer to say that classes in this subject are well attended, or that good grants are earned, and good results are shown. The point is, will it help to improve our agriculture? And it is, at least, reasonable to suggest that if the teaching of "Principles of Agriculture" is to be an object for the expenditure of

public money, that money might more usefully be spent among rural rather than urban children.

But is it not the case that the vast majority of the rural children are born apprentices to some form of agriculture? They are either the children of parents whose labour is upon the farm, and who train their children to work in their own gardens or allotments, and put them out to work as soon as they have passed the fourth standard; or they are the children of parents whose whole talk and thought is of breeding, rearing, feeding, buying and selling sheep or oxen, and whose chief anxiety is caused by the effects of the season on their grain, grass, and root-crops, whose chief interest is in the ups and downs of the produce and labour market.

Or they may be brought up to regard as the foundation of their own welfare the comfort and well-being of those by whose labour, skill and forethought, applied to the land which their fathers own, is derived the produce on which they themselves depend.

That is to say, most of the children in rural districts are those of the labourer, the farmer and the landlord. And I think I may venture to say that it is the children of the latter class alone—the class, that is to say, which has the least real and practical apprenticeship—who have in any degree the time and opportunities for being taught even the elements of the many branches of science which I have enumerated as bearing upon agriculture. And even this class, by the time they have passed through only the simplest courses in these great subjects, are usually past the age at which real apprenticeship is possible. The result is this. There are but few of them who in later life are not compelled to rely for the management of their home farm (to say nothing of their estate) upon the practical knowledge of their steward or bailiff, who, with less education and less instruction, has acquired his skill by practical experience and real apprenticeship.

It is true that one who has been well grounded and thoroughly taught the great principles of these sciences

may detect errors of principle in practical procedure; may see the futility of endeavouring to run counter to a fundamental economic or natural law; may be able to detect a source of waste of labour or material. But, as a rule, the contribution of this class of agriculturist to the management of a farm is financial rather than practical.

Bearing this in mind, we may, I think, derive from it some indication of the direction in which we may hope to turn instruction to the best account for the improvement of agriculture.

The farmer, the labourer, or their sons, though they live constantly in actual practical experience of some method of farming or another, have three disadvantages in comparison with the wealthier class of whom I have last spoken.

First, in point of money, they cannot command equally good instruction. Secondly, in point of time, they have less to devote to general education. Thirdly, in point of area, although they may be much closer to their field of observation, it is of necessity a much more limited one.

And the real question before us is, How can we best avoid or overcome these obstacles?

I. Probably the first and most important principle that must be borne in mind in considering this question is this that any instructions given to classes of boys who are not being specially prepared for the business of agriculture, must be confined to broad, well-ascertained, definite elementary principles.

Illustration of these principles is, of course, necessary for the purpose of instruction, and for this purpose certain well-chosen particular applications of the principles may be needed. But the knowledge of their application to the varied circumstances of different farms is matter, not to be imparted by instruction, but to be gained only by experience (or apprenticeship).

There are several reasons for this. First of all, it is practically useless (as far as the pupils are concerned) to deal with the minutiæ of science before classes of boys. They cannot attain to a sufficient apprehension of

principles to enable them to appreciate and carry away clearly in their heads the relation between the principles and the circumstances which modify them.

Secondly, teachers cannot be provided each of whom will be able both to grasp the principles with sufficient thoroughness to teach them, and to acquire experience of their own in the practical use of those principles, so as to give classes in our public elementary schools detailed instruction in the various methods of application.

Thirdly, the time available does not suffice for more than general treatment.

Fourthly, the object aimed at should rather be to stimulate observation, to enable and to induce the pupils to acquire the knowledge of facts for themselves.

II. There is also a second principle of almost equal importance. Not only ought the instruction in science to be confined to elementary principles, but the selection of the sciences which it is attempted to teach, and the order in which they are to be taught, should be considered with careful regard to the interests of the children who are to receive instruction.

It must not be forgotten that the lower we go in the social scale, and the less general education a child is likely to acquire from the circumstances of his position, the earlier he has to leave school.

The more need he has of teaching, the less he is able to get; and therefore, it is the more important that the little he has should not be wasted.

Our object, therefore, ought to be so to arrange the order of our teaching that at whatever age, and for whatever calling, a child leaves school there may be no portion of the time during which he has been under instruction which may not be fruitful in his after life.

The result of an application of this rule will be found to harmonise with another and a wider principle.

We shall find that if we commence with the most abstract science, that in which the facts are the simplest and the principles the widest, and if we proceed as the pupil grows

older to the more concrete sciences, in which the facts are more numerous and their relations to each other more complicated, we shall arrange the order in such a way that the most generally useful will be the earliest subject of instruction, and the more special ones will be deferred till later.

For instance, the tailor, the blacksmith, the carpenter, and the labourer must all be able to measure correctly as well as to count. The blacksmith, the carpenter, and the labourer must employ force as well as measure. The agricultural labourer, and the carter, and the shepherd must have some knowledge of animal and vegetable life. The farmer must be able to appreciate the work of each, and to superintend the management of his crops and of his stock, the care and use of his implements and manures, and last, but not least, the well-being of his labourers.

Therefore, the order would be—

1. Geometry, or the science of measuring.
2. Mechanics and hydrostatics, or the laws of force.
3. Chemistry, or the composition of soils, plants, and animal substances.
4. The structure of animals and vegetables, and the laws of their life, in other words, botany, anatomy, and physiology.

The very names of these sciences should almost deter us from thinking that they can be efficiently taught by ordinary schoolmasters in public elementary schools. And yet these are only some of those which underly the so-called principles of agriculture in which we are told that large classes are being successfully instructed.

There is every reason to believe that, for the purpose of teaching even any one branch of science, with special reference to its practical application, it would be indispensable that the teacher should, for the purpose of apt illustration, possess considerable actual experience of that special application in practice.

But it is almost, if not quite, impossible to find in the same person that real and solid knowledge of agricultural

practice, with all its complicated variations and difficulties, which can only be acquired by actual experience, such experience as those alone obtain whose living depends upon success in it, and also a real and solid knowledge of the art of teaching, which can only in like manner be obtained by practice, and for which a training not less special and arduous is in most cases equally necessary. Least satisfactory of all must be the result produced by a superficial learning of text-books by rote, under teachers whose real knowledge of the subject can be neither practical nor adequate, and one of whose motives must necessarily be, to some extent, the earning of grants for their schools, as distinguished from the steady training of the children's minds.

The phrase which of late we have frequently heard and read of, viz., "Principles of Agriculture," seems to me in itself misleading. It seems to regard agriculture as a science, whereas it is really a trade or business. No trade or business is wholly independent of science, but the difference between them is fundamental, and we cannot afford to lose sight of it. And it is in view of this fundamental difference that the gist of the foregoing remarks has been depreciatory of any attempt to teach practical farming in our ordinary schools.

But it is said with truth that the classes connected with agriculture need sound instruction to assist them to make the best of their circumstances, and to effect a general improvement in the agriculture of the country.

It is also said, but in my opinion with very much less truth, if any, that it is desirable that the State should endeavour to supply this instruction. One good reason against this is that the actual apprenticeship on which I have laid frequent stress cannot be afforded by the State, and yet is absolutely necessary as a part of the training. What then can be done? And who is to do it?

That good schools for general education can be established and maintained with success, educationally as well

as financially, has been amply proved by Prebendary Brereton and others in the county schools.

That general education is valued more and more by the middle class is being proved by the Oxford and Cambridge local examinations, and by Cavendish College, as well as by the system of unattached students at the two great Universities. But this is no "Teaching of Agriculture."

The Conference will hear what is being done with, I believe, real success at Cirencester and Downton. These institutions, however, only tend to prove one of the points which it is my object to make clear, namely that in order that agriculture may be successfully learnt, the teaching of the subjects connected with it must be undertaken with a special and direct aim at their application to agriculture; and in combination with the teaching of these subjects there must be constant practical experience. These two requisites render it in my opinion impossible for the State to found any general system for the teaching of agriculture.

But institutions like the Aylesbury Dairy, where right practice based upon facts of science and conducted with businesslike economy is successfully carried out, are really useful also for the purpose of technical training for those who wish to learn to farm well, or in other words, in accordance with the laws of nature.

The part which the State can play is, in my opinion, best confined to encouraging efficient general education.

Much no doubt is to be learnt, and indeed every year there will be more to be learnt in every branch of agriculture; but whatever efforts are made to provide practical instruction must be definite and special in their aim, and conducted on business principles.

Special technical training cannot be substituted for general education without serious loss. It may be engrafted upon it, no doubt, with benefit. But the more the tendency to substitute the smaller for the larger aim is allowed to have scope, the greater will be the danger of losing what is really of the greatest value in each.

The work of Sir J. B. Lawes, and of Professor Voelcker and others at Rothamsted and Woburn, have a scientific and a technical value which it would be difficult to over-estimate. But they are being carried out in a purely scientific spirit by men of the highest training and the fullest experience with special reference to the advancement of practical agriculture.

The real benefit both of a good general education, and of a sound training in any one or more branches of science,—the one result which will be of most value to the agriculturist is this—that he should be enabled to appreciate the immense amount that remains to be learnt, to realise how very little of science he himself knows, and therefore to distrust his own impressions, to discount the hasty generalisations of others not much better informed than himself, and to estimate at their true value the mature results of the conscientious and laborious investigations of scientific men.

The more thoroughly he has been grounded in any one branch of science, the more ready will be his appreciation of these facts. The more superficial his education, the larger will his own knowledge loom before his eyes, and the more abject will be his subjection to the "*idola fori*" and the "*idola specus*," the delusions of the market and the cave.

The more practical his experience, and the more complete his dependence for success upon his own knowledge of details, the more anxiously will he watch the progress of science, and the more keenly will he perceive its application to his own case.

I will only add in the first place, that I earnestly deprecate any appeal to the State for funds to assist in the foundation or maintenance of institutions to teach agriculture, because every pound given in that way tends to destroy the business character of the institution, and *ipso facto* to destroy its value, by thus removing its first requisite; and in the second place, that if any system of attaching farms to schools is entertained as a practical

proposal, it must not be forgotten that science is one thing, and business is quite another, and that one or other must have the upper hand.

If I am right in regarding agriculture as a business, and not as a science, I shall also be right in urging that the business character, and not the scientific character, will be for the farmer's son, in point of technical as distinguished from mental training, the most valuable. And it is for this reason that I have ventured to urge upon the Conference the wisdom of the mottoes of our agricultural societies in education not less than in after life: that science in farming cannot be separated from practice; that he who wishes to be taught must learn by work.

DISCUSSION.

Professor TOWNSHEND, of Ohio State University, said that the circumstances and conditions of agriculture in the United States were so different from those in this country that he felt that he was not prepared to discuss the question of agricultural education as it lay before the minds of Englishmen. If, however, he might venture to say anything, he dissented almost *in toto* from what had been stated in the last paper, and from very much of what was stated in Lord Fortescue's paper. He thought that agriculture could be taught. The last paper had said that it might be learnt, but could not be taught. He certainly differed from that idea. By way of elucidating the matter, he might give a chapter from his own history which would perhaps bear as directly upon this question as anything else. He was the son of an English tenant-farmer, and was born in the county of Northampton. Nearly sixty years ago he went with his father to the United States, where he was taught how to do all kinds of hard work, such as breaking cattle, ploughing with oxen, clearing away the forest, and other hard work which was done in pioneer life

in America. When he was about sixteen years of age, a gentleman called upon his father on business, and suggested that he should be sent to college. This suggestion led to his having a conversation with his father on the subject. He said to his father, "What do you think about what that gentleman said as to my going to college?" His father replied, "I think that that entirely depends upon the business in life which you wish to follow. If you wish to be a doctor, or a lawyer, or a minister, of course you will need a thorough education; and it must be classical and mathematical, for the sake of the training." He (Mr. Townshend) replied "I want to be a farmer." "Then," said his father, "I do not see how a classical or mathematical training in the great schools or universities, so far as I understand the teaching, could be of any use to you in farming." He said, "Father, would it not be of service to me to know something about chemistry, the composition of the soil, and how crops somehow or other deteriorate the soil, and then what I should put on to make the soil better? Would not that be of some service? Would it not be of some service that I should know something about animal life? We have animals. We are trying to produce better varieties continually, but how little do I know of physiology. I know, indeed, nothing of physiology. We are dealing with animal forces, and I know nothing about them. Then, again, we are working amongst plants day by day. I go and seek to promote the growth of some; and some I tear up and call weeds, but I know nothing about them. I do not know the principles upon which the plants are cultivated, or how they live. Would it not be of some service to me to have a knowledge of botany?" Perhaps it might be asked how he, as a country boy, knew the meaning of these words. His answer to that was, that his father had some books, and among them a good dictionary, from which he could learn the meaning of words, and he had learnt the meaning of these words. His father said to him, "I can see that these studies would be valuable to the farmer, but you could not obtain an

insight into these branches of science in any of the colleges we now have in Ohio." The colleges in the State where he lived at that time were all denominational. They were intended to prepare ministers of various religious denominations. They taught Hebrew enough to read the Bible, and Greek enough to read the New Testament, and a great deal of dogmatic theology, but science was almost left out. His father was right in saying that he could not get a scientific education in the colleges as they were round about him. His father told him that in order to get such an education he would have to go to a medical college, where they taught such things as physiology, chemistry, and botany. He then said, "When I get to be a man I will go to a medical college." When he became a man he carried out that purpose, and he did get some little insight into physiology, and chemistry, and botany. He afterwards practised medicine for a number of years, but unavoidably and in spite of himself circumstances led him into political life and obliged him to give up his profession. He afterwards went back to his father's farm, and it then occurred to him that something might be done for the farmers, and he tried to start an agricultural college. Three gentlemen were associated with him, and they instituted a course of lectures very similar to those which are now given at South Kensington, he and his three associates lecturing by turn. The lectures embraced matters pertaining to animal life, vegetable life, geology, chemistry, and physics. That work was discontinued after three years, with the prospect of obtaining State aid to a better institution. In 1862, the United States Government made appropriations to the States for aid in technical education, partly agricultural and partly mechanical; and in the State of Ohio a college was established for the purpose of giving such instruction. He was at the present time connected with the teaching of agriculture in that college. There were now about three hundred and fifty students in attendance. It was now a university, and consisted of six departments. There was a department of

arts, which included the linguistic training of the old universities; also a department of science in which French and German were taken as optional, and departments of Civil, of Mining, and of Mechanical Engineering, and of Agriculture. Young farmers could come to that institution and take a two-years' course, or they could stay longer if they were willing to do so. They could acquire a good knowledge of chemistry, botany, and physiology, and some knowledge of veterinary medicine. When they had finished their training, they were prepared to be vastly better farmers than they were before.

Mr. CLEMENTS said that he disagreed to a very great extent with Lord Fortescue's statements. His Lordship seemed to think that the less they taught children in rural districts the better. That really appeared to be the gist of his paper. He (Mr. Clements) thought on the contrary that the more they taught children in rural districts the better. Lord Fortescue in one part of his paper protested against preparing children for standards six and seven. He (Mr. Clements), as a manager of a large school in London containing nearly 2000 children, knew that many children got into the sixth and seventh standard when they were about eleven years of age, and what was done in London could, he believed, be done in the country. For a person in the position of Lord Fortescue to protest against preparing children for standards six and seven, was, he thought, a great mistake. He held that they ought to give children in rural districts all the education they could, and especially the children of labourers. They ought to be taught the principles of agriculture so that they might understand the principles upon which their living would depend. The opinion had been held that the agricultural labourers ought to be taught all the principles of the various sciences which referred to agriculture, and he believed that they could be so taught. They could be taught elementary science referring to soils, and to plant-life, and to animal-life, and to the various operations of farming. All those subjects could be taught in an elementary way, and at the present time the

great majority of the farmers of the country really did not understand much more than elementary science. Many of them did not even understand that; if the children of labourers were taught in the elementary schools the elementary principles of science, they would take a far greater interest in their work than they took at the present time. Many of their operations were merely performed by rule of thumb, but if the scientific principles were taught to them, they would take a greater interest in their work. He thought that it should be the object of education in this country, as it was the object of education in foreign countries, to teach children so that they might be able to profit by their education in the business to which they devoted themselves. With regard to agriculture on the Continent and in the United States, the principles of agricultural science bearing on agriculture were there taught, and that was what ought to be done in this country. From the very highest to the lowest—from the landlord down to the labourer—they ought to be taught all that could be possibly taught them with regard to the business of life to which they would afterwards devote themselves. The author of the last paper seemed to think that advanced science could be taught in elementary schools. That was a great mistake. They could not teach advanced science in elementary schools. The reason that agricultural science was not taught in Board Schools in the country was entirely the fault of the farmers themselves. Farmers of this country had so far set themselves to a great extent against the teaching of science; and he thought in that respect they had made a great mistake. With the last speaker he believed that the more they taught the children in the rural districts, and the more they were led to understand the principles on which plant-life depended, and the nature of the soil and the nature of manure, and the more they taught them of what they saw around them, and the more practical the teaching, the better. We were coming to what might be called a fresh phase, and they ought really to go in for teaching all who were con-

nected with agriculture to bring their education to bear upon those principles of science upon which agriculture was based.

Mr. F. J. LLOYD (Lecturer on Agriculture, King's College) said that he thought those who most understood the difficulty of teaching agriculture would thoroughly agree with much which was contained in the two papers which had been read. Lord Fortescue had said that the object was to teach children how to think and how to learn. It was important, especially for children in an agricultural neighbourhood, that they should be taught how to observe. He thought that it should be borne in mind in attempting to teach anything to children, that what we really wanted was to train the faculty of observation. Herbert Spencer in his excellent work upon education said, "Observation is an element in all success," and he (Mr. Lloyd) was sure that it was the greatest element in the success of a farmer. Some persons who spoke of agriculture seemed to think that agriculture was practice, and some seemed to think that agriculture was science. The fact was that agriculture is the combination of the two, and the great difficulty with which they had to contend was to teach both. Could practical agriculture be taught? He thought that the boy who learnt in the field with his father, his father being a thoroughly accomplished agriculturist, was certainly taught practical agriculture. If he were only taught how to hold the plough properly he would be learning the practice, and practice could be taught. But that which could be done in schools was to teach the science of agriculture, which was altogether distinct from the practice. It threw a light upon the practice, but it was not the practice, and it was this teaching of the science of agriculture which could alone be accomplished in the lecture-room or in the school. The question arose, "Is it possible that farmers' sons can attain that knowledge?" He thought that there could be no doubt whatever that it was possible; but that they should learn the elements of chemistry, and of botany, and of physiology, was practically impossible. All that they

wanted to know was how the elements of those sciences threw a light upon agriculture, which would enable them to understand their practice, to appreciate it more fully, and to realise what they observed. If the teachers in the elementary schools of the country had a knowledge of the elements of science, so that they could take the children out into the fields and there teach them that science instead of doing it in the lecture-room; could take a plant, or an animal, or a portion of the soil, and teach them to observe what they would not naturally observe, and so teach the elements of botany and physiology and chemistry, the science so learnt would be essentially good. It would be useful to the boys in after life. One word with regard to text-book learning. It was of no service to learn by rote from men who understood neither the practice, nor, he was sorry to say, the science either. The majority of the text-books were wrong in both science and practice, and a system of cram had arisen throughout the country in the attempt to teach what were called the principles of agriculture, a subject which could be entirely taught from a book but would throw no light upon agriculture, and give no true idea of the scientific principles which underlay agriculture. What was wanted was—again quoting the words of Herbert Spencer—"an accurate acquaintance with the visible and the tangible properties of things. Our conceptions without these must be erroneous, our inferences fallacious, and what is more important, our operations unsuccessful." In these few remarks, of course, he was limited to the subject which was covered by the papers—the teaching of agriculture in elementary schools. He thought that much could be done to teach both the practice and the science, if they would only keep them apart and remember that they must be learnt separately, though they combined in agricultural work. It was not necessary to a man in order to be able to grow a crop of corn that he should understand anything whatever about the physiology or the botany of that corn. At the same time, if he did understand the botany and the physiology

of his crops, and his animals, and the chemistry of his soil, he would, in his practice, be able to contend against difficulties which the man whose work was rule of thumb had to succumb to.

Professor ARMSTRONG said that he should hesitate to say anything on the subject of the papers, especially after the very clear statement which had been made by the last speaker, were it not for the remarks which were made by the first and second speakers (Professor Townshend and Mr. Clements) who certainly, as it appeared to him, entirely misunderstood the papers. The first speaker, while expressing his disagreement with them, proceeded at once in the clearest possible way, to prove the case which had been stated. His speech was the most admirable proof that could possibly be given in acknowledgment of the correctness of the papers. He (Professor Armstrong) only wished that one could feel convinced that these two papers fairly expressed the opinion of agriculturists throughout the country. He feared very much that they should have to wait long before farmers generally would be prepared to acknowledge the truths which the papers contained, for it seemed to him that those two papers together furnished a most enlightened exposition of the requirements of agriculturists at the present time. Mr. Acland in his paper said, " To put it shortly, we can teach our children some of the broad facts of nature in her three great divisions of organic matter, inorganic matter, and the laws of the various forms of force." That statement, provided that it was amplified in the direction which Mr. Lloyd had indicated, seemed to be really a complete statement of the requirements of the case. The object was not merely to teach facts, but to teach the facts in such a way as to develop the intelligence of the pupils. There could be no doubt whatever that what farmers required at the present time was to develop the intelligence of their bailiffs and their own intelligence, and they did not want teaching such as had been given in books. Farmers did not for a moment object to science, but they objected to the way in which the attempt was at present being made

to teach what was called science. They objected to the way in which certain text-books were being put into the hands of students which were supposed to deal directly with agriculture, and to teach the elements of it to students who had not the ghost of an idea of the principles underlying the science. That was what farmers objected to, and he believed that they were quite right in objecting to it. He believed that farmers were in the same position in which the schoolmasters were with regard to the teaching of science. They were not satisfied with the method which was being put forward, and until they were satisfied with the method of teaching they would not give their assent to it. He thought that that really was the point. What we wanted, as he had said in a discussion two days previously, was that the knowledge of natural objects and natural phenomena should be carefully taught in the schools, and they could not hope that the third class, which had been referred to in Lord Fortescue's paper—the class of the labourer—would be able ever to appreciate the applications of the scientific facts and principles which were brought before them. All that they could hope was, that if a very elementary system of science teaching was introduced into the primary schools, it would be possible for the teachers to select certain pupils as being particularly apt, and that those pupils would be induced—if possible, compelled—to carry on their education by means of the evening schools which were advocated in another Section on the previous day; and that it might then be possible for some to go still farther and to acquire higher and more specialized instruction. Of course farmers' sons and land proprietors should receive a more thorough instruction, such as was being given now at several of the agricultural colleges. There was no doubt whatever of the truth of what Mr. Lloyd said, and what was hinted at in one of the papers, with regard to the present teaching of the principles of agriculture, as it was called, under the Science and Art Department. It would be very interesting and very instructive, he thought, if they could have statistics showing

what proportion of the students coming up under that system were from the rural towns and what proportion from the large cities. He believed that the results would show that but a very small proportion had the slightest intention of going in for agriculture. He believed also that it would be shown that agriculture was a cram subject, and was taught by the teachers simply with the object of earning the grant. He did not say for one moment that it was not desirable that the Science and Art Department should teach it, but he asserted that the teaching should be of such a kind, and that the examination test imposed should be of such a character, as to render it impossible for the subject to be taught in the way in which it was being taught now; that is to say, by certain text-books being put into the hands of the students, the subject being taught by rote. He did not believe that if they came to examine those who were being taught they would be found to have any really suitable or valuable knowledge of the subject.

Professor TOWNSHEND said that he took it for granted that the subject of discussion was what was laid down in the programme—the teaching of agricultural science. On the question of whether science should be introduced in primary schools, he had nothing to say. He supposed that his remarks did not apply to the introduction of science into primary schools, for he did not know that that was the subject of discussion.

The CHAIRMAN (Mr. St. John Ackers) said that as there was no other speaker it was his pleasant duty to make a few remarks upon the papers and upon the observations of the various speakers, and more especially to move a very hearty vote of thanks to Earl Fortescue and Mr. C. T. Acland, M.P., for the papers to which the Section had listened that morning. He doubted whether there was any paper on any subject which everybody could agree with, and he doubted whether any two people would practically agree on every line and sentence in another person's paper. There were certain points in

Lord Fortescue's paper from which he should dissent, but in the main he thought that the two papers were such as not only should have brought about a fuller discussion than they had received, but were very suggestive and useful. He very much regretted that the number of agriculturists in attendance was not larger. The reason was probably the time of the year at which, unfortunately, the Conference had to be held. The managers of this International Conference were obliged to fix it at that particular time because they were bound to consider when the different schools of the country broke up for their vacation; and more particularly as this was an International Conference, it was absolutely necessary that they should consult the convenience of foreign nations, and they found that it could not be supposed that they could have foreign representatives from any nation until the beginning of the month of August. This was the first international conference on education which had ever been held in this country, and it was considered that it would have been a misnomer had it been held at a time when the foreign representatives could not have been present. He believed, however, that there was another reason for the smallness of the numbers, and that was, that a misunderstanding had occurred with regard to the sending out the notices in sufficient time. As to tenant-farmers and labourers being present, in anything like the numbers which could be desired, that was perfectly impossible, considering the glorious sunshine outside. He took it that it would be the worst possible appreciation of what was necessary for agriculture, had those engaged in it left the work of the nation to come up to London and listen to papers which they could read afterwards, and which he hoped would be read throughout the country. With regard to Mr. Acland's paper, without agreeing to every single word in it, he felt that it was a very valuable paper indeed, though he entirely dissented from it in one or two points. He disagreed with that point in which Mr. Acland said that no extra State help could be given for this most important of all industries in

this country, namely, agriculture. He entirely dissented from the proposition that if State help was given it would be a misfortune to agriculture. That was a point which he took this early opportunity of showing that he traversed *in toto*. He quite agreed that all help was mischievous if it ceased to be help and became patronage, but it had not been found so. He thought that he might ask those who had attended the Conference on other days and listened to the admirable papers and to the admirable discussions which had taken place in that Hall of the City and Guilds of London Institute, whether the help which had been given in the last few years to the teaching of science and art had been detrimental to the welfare of the industries of the country. Very far from it, at any rate, had been the opinion which had been expressed over and over and over again within the last week in that very room. To say that we wanted nothing more from the Government in the shape of help than that which we now got was a retrograde step, for he thought that public opinion had already reached a step far in advance of that, and desired that proper help should be given, and given speedily. With regard to the remarks which had been made by the different speakers, he could only thank Professor Townshend for coming before them and giving them his experience with regard to America. He thought on the other hand, as had been well pointed out by Professor Armstrong, that he answered the objections which he had himself raised. Doubtless Professor Townshend had somewhat misunderstood the purport of the discussion, because in the announcement in the programme it was considerably different from the headings of the papers which had been read. At any rate there was one point which struck him (the Chairman). Professor Townshend himself was evidently a practical farmer before he became a teacher; and if we could only get practical farmers to become teachers of the science of agriculture, or rather of all those sciences which went to make up the great art of agriculture, he for one should say that we had, indeed, arrived at a condition far in advance of anything

which existed at the present time throughout the length and breadth of the land. With regard to what Mr. Clements said, although he was very glad to have heard his remarks, he thought that it was a little unfortunate that those gentlemen who were not in any way connected with practical agriculture, and did not live in the country, should take such an entirely antagonistic view from that which was commonly expressed. Whenever there was a very strong opinion expressed we might depend upon it that there was something in it, although it was possible that might be wrong. He rather thought that Mr. Clements was not present to listen to the admirable remarks which fell from Mr. Lloyd and Professor Armstrong. With regard to those two gentlemen, he (the Chairman) could only thank them for having given their cordial and happy help. Those gentlemen were ready to bring about a union between real practical scientific teaching and the practical teaching of agriculture. He would now ask the meeting to vote their thanks to the readers of the two papers.

The vote was carried by acclamation.

Earl FORTESCUE thanked the Section for the great kindness with which the mention of his paper had been received. Referring to Mr. Acland's paper, he said that he thought it was a most valuable one. There was only one point upon which he particularly differed from the writer, and that was as to the amount of abstract knowledge which could be given in very early life. Some of the very highest physiological authorities said that in childhood the power of memory and of observation was acute, but that the power of dealing with abstractions came later. Desirable as it would seem to be that the foundation should be laid early, he feared that children would not have time for learning all the elements of all the sciences which Mr. Clements thought could be advantageously known by them before the time at which they had to begin earning; for such children could not go on learning indefinitely without a great burden to the public in consequence of the cost of their maintenance and the

loss of their labour. Of course it was desirable that we should all know all about everything: but life was short, and there was a great deal else to be done in it besides learning. There was the work of earning to be done by a great proportion of the people. He entirely agreed with Mr. Acland's general views. On only one point was he at all shaken. He believed that scientific investigations in agriculture, as in astronomy and other things, as distinct from aids to instruction, might be assisted by the Government. Such investigations were necessarily very unremunerative directly to those who carried them on, though of great value indirectly to the community. He protested, however, against schools founded by Government, and against State-created and State-supported instruction. With regard to the views expressed by Professor Townshend, he would remark that Mr. Townshend went to the university and studied medicine after the age of sixteen. By the age of sixteen a very large proportion of the sons of farmers, and much more of labourers, must be earning, and not merely devoting their time to study. There might be a few exceptions, consisting of those who might be such extraordinary burning and shining lights, that they might very properly be carried forward by scholarships, and maintained, not at their own expense, but by the public. Mr. Townshend told them that it was a great thing to have the sixth and seventh standards open to everybody in all schools. If there was one principle of more value than another practically, it was the division of labour. How many children, in a small elementary school in the country, could wait for the sixth and seventh standards? The master might have to spend time and labour in teaching one or two boys what could be far better taught in a large class, and might be taught very well in a school of a thousand pupils. In a large school the division of labour could be carried out, but it was far more economical and desirable in every way that the higher standards should be taught, not in elementary schools, but in schools above the elementary, to which the deserving should go up by

scholarships. Observations had been made as to the value of all classes of society knowing a great deal. It was very desirable that all classes should know a great deal, but we had to deal with an imperfect world, and with actual men and women. He attached very little weight to these generalizations. With Mr. Lloyd's remarks, as to the great value of training the faculty of observation, he entirely agreed; and he was glad to find that, on the whole, Mr. Lloyd took a view so much in accordance with his own, and that which Mr. Acland and he (the Earl) had quite independently arrived at. What Professor Armstrong had said about a great deal of the teaching of agriculture, he believed to be very well founded. He thought that as it was conducted at the present time, it was looked upon more as a means of getting grants than anything else; and the proof of that was the small proportion of farmers' sons who went in for those classes. The scholars who learned those subjects were not the inhabitants of rural places, but the sons of tradesmen, or others who had no intention of following agriculture in after life. The subject was learned from text-books, but meanwhile the schools got grants. He could only say, in conclusion, that he had heard nothing whatever to shake his conviction of the general soundness of the views which he had laid down, that the great object was to teach children how to learn and how to think. We must not lean too much on Government, or on cut-and-dried schemes and systems; but we must depend very much for the future of English agriculture upon what had hitherto kept England pretty much in the van of the agriculture of the world, namely, our own efforts and co-operation among ourselves and among all classes.

Sir THOMAS ACLAND, in replying to the discussion on behalf of his son, the author of the paper, said that he wished it to be understood that he was not in the slightest degree responsible for the paper. The paper was written abroad where he and the writer could not communicate with one another, and it stood on its own basis. He re-

gretted that his son was not present to defend it himself. With regard to a remark which had been made by Lord Fortescue, if he (Sir Thomas) understood the writer's views, he did not advocate that the children should be taught abstractions. If by "abstraction" was meant such a fact as that the three angles of a triangle were together equal to two right angles, he thought that a very young boy was perfectly capable of taking that in. He understood that Mr. Acland's point was that they should not give boys smatterings of the higher subjects under pretence of teaching them science. If he might give his own opinion, he would venture to thank Professor Armstrong for what he had said on a former day with regard to the way in which chemistry should be taught. In endeavouring to teach young men of sixteen, who were intended for agriculturists, it did not do to begin by giving them complicated compounds of oxygen and hydrogen, and metals and so on. They could not see what such things had to do with them. But if the teacher began at the opposite end and analysed for them gluten and starch, and the fat and the flesh of an animal, and showed them how those substances were connected with food, and so worked backwards from the compound to the elementary, the teacher would be able to engage their attention and interest them very much. The proper course for the professors who undertook to teach the benighted farmers, as they were thought to be, would be to have the kindness first to find out how very much farmers knew, and to endeavour to throw a little light on the business of their life, by helping them to understand the reasons of the multitude of complicated facts which a common farmer knew. Some five-and-thirty years ago his friend Mr. Pusey set him to work to study agriculture, and to get up one of the county reports of the Royal Agricultural Society, and for seven years, as the editor of the Journal of the 'Bath and West of England Society,' and since as chairman of the Journal Committee, he had been doing his best to simplify the complicated scientific knowledge which bore on agriculture and to adopt

it to the capabilities of the ordinary farmer; but still he never went on to his own farm and talked to his bailiff or to his shepherd without being made to feel his own ignorance, for those men knew something which he (Sir Thomas) did not know. Mr. Acland had suggested in one part of his paper that an educated proprietor might go upon his farm and here and there find out a possible loop-hole of waste. He (Sir Thomas) had tried to do that, but he was constantly met by the practical knowledge which was possessed by the working men, for they knew a greal deal more about the matter than most of the educated gentlemen did. He was extremely glad to listen to what had been said by their friend from America, but that gentleman appeared to him (Sir Thomas) to be proving the case which had been set up in the paper. He had stated that before he went to learn certain sciences he spent sixteen years on his father's farm. That was exactly what he (Sir Thomas) contended for, only he wished to tell the scientific gentlemen that when they set up their science classes the students did not want long cahiers, after the fashion of continental professors, read out to sleepy pupils. That was not our English way of learning. Therefore he hoped that when the scientific professors began their lectures and taught the farmers, they would come close to the work. That was what the Section had been learning for the last two days. The scientific teaching must be in close contact with the business of life, and also it must be so without losing its scientific character. There was one point which he did not think that he had heard much said about in the discussion. Teaching was a very complicated art. He spoke in the presence of the long-tried teacher of the Devon County School, Mr. Thompson, who had the courage to go and gain his degree at Cambridge after he was a head-master, and he had been a practical teacher for many years. That gentleman knew the truth of the opinion that they needed to develop accuracy and observation in scholars, to prevent them from blundering and being slovenly. An eminent man had said to

him with reference to the subject of teaching drawing, "Don't adopt that system of teaching children to draw squares and curves and lines. It will not interest them. Tell them to draw something such as a cat or a wheelbarrow, or something or other that they care for. Try and get them to take an interest in it and develop their accuracy by degrees." He could only say that as a father he had begun at the wrong end in this respect, and his children had taught him a great deal.

A paper on the same subject, by M. Gillekens, School of Agriculture, Vilvorde, Belgium, was read by Mr. S. B. L. Druce.

TEACHING OF AGRICULTURE.

By L. G. Gillekens.

Thanks to the agricultural teaching which was inaugurated as a trial in 1849, and finally organised by the law of the 18th of July, 1860, the rational culture of the land has taken firm hold in the country, and in order to develop it more and more and increase the national wealth, the Government has not hesitated to introduce in the programme of the normal and primary schools the elements of agriculture, of horticulture, and of arboriculture.

It is a wise measure, for no one better than the teacher can prepare the child to interest himself in the things which surround him, and to make him apprehend all the advantages of a country life. It will be the best check put upon the tendency of the country folk to emigrate into the centres of manufacture, this being a mania of the time, the principal cause of the decrease in value of rural property, and the most potent factor of pauperism.

On account of its dense population, its topographical position, its easy means of communication, and the diversity of its soil, Belgium is in a condition most favourable for

undertaking agriculture, the only industry which is profitable, and capable of providing constant work for the greater part of the labouring class. It is on the teacher that is incumbent the mission of popularising this pursuit and showing all its advantages. This will be all the easier to him as he will have imbibed ideas of horticulture in the normal school, and will be able to apply them in the garden annexed to his school.

Fair results have already been obtained. We have been able to observe this in the competitions organised a few years ago by the Agricultural Society of Brabant and the Agricultural Society of the Province of Namur, among the primary schools. The former organised competitions in Agricultural Instruction and Hygiene, among the normal schools of several "*cantons*." The following is the programme:

1. Importance and advantages of tilling the soil.
2. Appliances used in tilling.
3. The horse, ox, and cow compared as draught animals.
4. Weeds, their destruction.
5. Stubble-ploughing, hoeing, weeding.
6. Exhaustion of the soil; restoration.
7. Use of farm-manure.
8. Importance of air and light.
9. Ventilation of dwelling-houses.
10. Ventilation of stables, stys, &c.
11. Diet for man.
12. Food for farm stock.
13. Cleanliness, baths, clothing.
14. Rest, sleep.

A jury appointed by the Society visits the competing schools. There they question the pupils on the subjects of the programme. According to the average correctness of the answers, the teacher receives a first, second, third, or fourth prize; the respective values of which are £8, £6, £4, and £2. Several times I have been president of the jury; I have thus been enabled to appreciate in all its details the usefulness of such teaching, and the good results

obtained by devoted teachers with children of ten to fourteen years of age.

In order to stimulate the zeal of teachers, and to popularise the culture of vegetables and of fruit-trees, the Society of Agriculture and Forestry of the Province of Namur has, with a praiseworthy zeal, established competitions among all the schoolmasters of the province for the best school-gardens. As I have also been a member of the jury appointed to award prizes, I have been convinced that the teacher exerts a great influence on the inhabitants, on the good state of their gardens and the care bestowed on their fruit trees.

Wherever the schoolmaster has taken part in the competition, I have remarked that the gardens belonging to workmen and private individuals were generally better kept than elsewhere, and that the better varieties of vegetables and fruits were spreading. The teaching of the elements of agriculture has been organised on trial, by the Ministry of the Interior, which, conjointly with the Ministry of Public Instruction, controls the teaching of agriculture in certain secondary schools established in the agricultural districts. The lessons are given by professional agriculturists or by veterinary surgeons. The programme comprises the following:

1. Study of the laws of vegetable growth, physiological laws relating to the rotation of crops.

2. Tilling of the soil.

3. Cultivation of roots, &c.

4. Appliances used in tilling.

5. Weeding; means employed for the destruction of vivacious plants; e.g. dog's grass or couch-grass.

6. Sowing-time.

7. Choking-weeds.

8. Preserving and increasing the richness of the soil by manures. The necessity of returning to the soil the substances removed by the growth of the crops.

9. The importance of saving all manure, solid and liquid. The necessity of buying manures to supply what has been removed by plants and animals, and to supplement stable-manure.

10. Farm-manure, its preparation and preservation. Carelessness in this respect. The profits in agriculture depend on the due administration of manure; and this on the proper way of feeding and keeping the live-stock.

11. The elements of hygiene.

Till 1881 the elements of agriculture, of horticulture and arboriculture, were little attended to in elementary normal schools, hence the results were not satisfactory. If some teachers have succeeded in giving to their pupils instruction which has been of use to them, we must attribute the result to their private studies after leaving school and to the lessons given by specialists at the quarterly Cantonal Reunions.

Only since 1881 have these subjects found a place in the programme of the elementary normal schools, in which they ought to have been included long ago. The elements of agriculture and horticulture are taught to pupils of the third year. The programme includes:—

1. The soil. How arable land is produced; soil and sub-soil; constituent elements; varieties of soils; classification; description of typical soils; advantages and disadvantages of each; their improvement; division of Belgium into agricultural regions, according to the soil.

2. Preparation of the soil; ploughing; stubble; harrowing, &c.; use and effects thereof; tools and appliances.

3. Drainage, uses, methods.

4. Irrigation, use, water used, method of using.

5. Manures, their necessity. Farm manures, their origin. Bedding, composition of, importance. Manner of gathering, preserving and preparing.

6. Sowing. Choice of seeds or grains; comparison between broadcast sowing and drilling.

7. How to protect crops; weeding, hoeing, earthing, necessity of appliances.

8. Fuller study of manures, chemical elements contained in them; how they act on the soil; how utilised by plants. Classification of manures; summary study of the chief

kinds: bone, phosphates, superphosphates, guano, &c., lime, gypsum, seaweed.

9. Elementary notions on various systems of cultivation; rotation and variation of crops.

10. Farm animals; hygiene; summary of principles involved in housing animals; cleanliness, exercise, rest.

11. Vegetable garden; explanation as to its form, extent, distribution and succession of crops.

12. Work needed; manures used.

13. Methods of multiplication, cultivation, and preservation of vegetables most generally useful.

14. Care given to the pods of plants; the gathering and preservation of seeds.

This programme is complete. It embraces all matters referring to agriculture, and market gardening which it is advisable to popularise in country districts.

The professor occupies thirty hours in elaborating this course. This is very little, but if the system of object teaching is largely employed, the happiest results will ensue. It has been my good fortune to assist at lessons in agriculture given by teachers who had studied in schools where agriculture is taught in the most practical manner, and I have been astonished at the results they achieved in different districts, by infusing into the minds of their young pupils those principles which underlie the successful development of our national agriculture. Hence, the Government cannot be too careful in its selection of professors to teach agriculture and horticulture in our normal schools. As the programme is very extensive and the time most limited in which to develop it, the work should be confided to specialists who fully understand their task and know how to bring out the essential features of the curriculum. Arboriculture in its relation to fruit cultivation is also taught to pupils of the first and second year. The first year embraces:—

1. Multiplication of fruit trees; nurseries, establishment and development; seed plots; layers, cuttings, grafting.

2. Transplanting, time of; choice of varieties; of specimens in each variety; removal; pruning; preparation of place for transplanting; placing; aftercare.

3. Pruning of fruit trees, object and advantage of; various forms in annual vegetation; bud, blossom, boughs, branches; production from trees having kernel in fruit; when to prune trees; how to perform winter trimming; how to perform summer pruning.

4. Cultivation and pruning of the pear and the apple tree; forms of; standards, espaliers; framework needed; management of fruit.

In the second year the programme comprises:—

1. Revision of previous course.
2. Cultivation and pruning of the peach tree.
3. Cultivation and pruning of the vine.
4. Insects and diseases which most frequently attack fruit trees. Removal of caterpillars.
5. Gathering and preserving of fruits.

Of all the sections of instruction in normal schools, arboriculture, as referring to fruit trees, is decidedly most important. This arises from the practical character of the teaching given. For this end the programme specifies that the lessons must be given in the garden. To this fact we may attribute the success of such teaching, when the professor is thoroughly acquainted with his subject, and when he is, moreover, familiar with the ordinary principles of physiology as applied to plants, which will enable him to be so much more clear in his lessons on the treatment of fruit trees.

It is also to be remarked that normal scholars seem to attach more importance to experiments in the cultivation of fruit trees than in what refers specially to the cultivation of land. This doubtless arises from the fact that they know that, once appointed masters in a rural district, they will have a plot of ground at least ten acres in extent, in which they will cultivate fruit trees, and that, moreover, they must be thoroughly conversant with the subject, since the time allotted for arboricultural experiments is but ten

hours in all. This is but slight, since each section of ten pupils should have at least twenty hours, that the teacher may devote more time to questioning, and that he may be assured that the pupils have fully understood all that he has explained.

The programme of elementary notions of agriculture and arboriculture, in primary and intermediate schools properly so called, embraces all that relates to tillable soil, to subsoils, to the improvement of land, weeding, hoeing; to manures; the choice of seeds, the cultivation of vegetables; the care to be given to stock; the multiplication and the pruning of fruit trees.

In conclusion, the teaching of agriculture and arboriculture in the lower, middle, and normal schools of Belgium embraces all that is necessary for the ordinary farmer to understand.

The schoolmaster must be a bond of union between scientists and the farmer, that the latter may reap the benefit of all progress made by the former. Farmers must be made to understand the advantages of close cultivation, which will add to the sum of ordinary labour, while increasing personal and national wealth.

DISCUSSION.

Mr. E. M. Dixon said that he thought that the paper was perhaps a little wanting, for an English audience, in explanations about the school system which was generally adopted in Belgium. There was a variety of schools spoken of in connection with the teaching of agriculture, and, as he did not know particularly well the education system of Belgium, he felt himself at a loss to understand the paper as he should like to do. In the very first paragraph normal schools and primary schools were spoken of, and other paragraphs seemed to state that the teaching of

agriculture had been introduced into both. He thought that he gathered from the paper that in the primary schools the teacher was the ordinary schoolmaster. They had heard opinions expressed in connection with two other papers about the insufficiency of the ordinary schoolmaster to give instruction in agriculture. It was therefore worthy of remark that the primary school seemed to have been giving some elementary instruction, at any rate, to the satisfaction of the author of the paper. With regard to the normal school, he also found in the last paragraph but one, the remark—"In conclusion, teaching of agriculture and arboriculture in the lower, middle, and normal schools of Belgium, embraces all that is necessary for the ordinary farmer to understand."

Earl FORTESCUE said that he observed that it was mentioned that although some agricultural teaching was inaugurated as a trial in 1859, and finally organised in July 1860, they were told that it was not until 1881 that the elements of agriculture, horticulture, and arboriculture were much more than introduced in elementary normal schools; and hence the results mentioned in the satisfactory account which was given of the happy influence of these schools on their present footing seemed, as far as he could gather, to have been only produced since 1881. The period which had elapsed since then was too short to justify speaking very confidently of the durable results of so newly introduced a system. There was an old English proverb that "new brooms sweep clean." The tendency of newly-created institutions was to work disproportionately well at first. As a rule, those who started them were enthusiasts, benevolent in their aims, and with very genuine interest in the work, and therefore one could hardly judge fairly from the results of the first two or three years. We must remember that we were only in the year 1884, and that until 1881 very little was done. He confessed that before judging of the practical value of a system which appeared from most authentic statements to be working well, he should like to hear a little of what had been done at the end of ten years,

and how the system was going on then. In connection with the training of farmers' sons and labourers, there was a point which ought to be borne in mind. The same marvellous principle of the hereditary transmission of qualities, so conspicuous in animals, that, for instance, a young retriever retrieved almost without being taught, and a young pointer pointed almost without being taught, applied also to human beings; and some of the best physiologists and most competent men had spoken of the very greatly increased difficulty experienced, as a rule, by those who had descended from generations which never had been called upon to deal with abstractions, such as the principles of grammar or high mathematics, in mastering abstractions, though for generations their habits of observation had been very much developed. This was particularly to be noticed in relation to the teaching of grammar to young children. The difficulties experienced by children descended from generations of the hewers of wood and the drawers of water in mastering abstractions, was beyond all proportion greater than the difficulties experienced by those who had descended from generations of persons blessed with higher culture; and great allowance ought to be made in determining the period of life at which such studies ought to be pressed. His conviction was, that some of the over-pressure complained of now arose from men of culture not adequately estimating the difficulty which they inflicted upon the children of those who inherited qualities different from those possessed by themselves. The paper was a very interesting one, but in the absence of the writer he did not know quite enough about the system of education and the lines of demarcation between different schools to be able to draw many practical lessons from it; and above all, as he had said, they had not had the benefit of longer experience of its working. He was quite satisfied that nothing was more delusive than drawing inferences from a too narrow or too short experience, from, for example, trying a thing only for one season, or upon a very small plot of ground, as every one who had tried agricultural experi-

ments knew. Therefore we must suspend our judgment before we pressed for the establishment by our Government on a very large and costly scale of anything analogous to the system which had been advocated, when the results cited in support of it had been gathered from a three years' experiment only.

The Rev. F. LEAVER (Rector of Chalvington, Sussex,) said that he should like to ask one question. If he asked his farmers to support the National schools, they told him that the children were too much taught already; and when the advantages of education were pointed out to them, they told him again that instead of getting better workmen, better shepherds, better carters, and altogether better farm-labourers, they not only did not get better men, but they had a difficulty in getting men at all. The education which the children of farm-labourers got in the schools at the present time fitted the boys for clerkships, and they could very easily get situations as clerks, where they could earn from perhaps five to eight shillings a week. Such employment took the boys away from the country parishes, so that the farmers had a difficulty in getting boys to do the work. He thought that as education improved and increased in the country we ought to get better farm-labourers. Could not the improved education so work in the boys as to make them more valuable to the employers of labour in their own parishes and thus prevent their going away? He should like further to ask whether the advanced and increased improvement in education should not be counted in the way of an apprenticeship, so that instead of being apprenticed for six or seven years, which was the custom, a good education should lessen the period, so that they could earn some part of their living earlier than they had been accustomed to do. In this way the education might be advantageous to their parents. Parents were anxious to get their boys as quickly as possible into work for the purpose of helping to support the family, and that was the reason why parents had set themselves so much against education. The boys were kept at school, and the parents

found a difficulty in providing them with food and paying the ordinary school fees for them. If we could improve this matter in some way, and through making them better workmen enable them to earn more wages, or, as they were better educated, reduce the time of apprenticeship, it would make it much more easy to get them to become tradesmen and to take up trades, rather than go away and seek after clerkships as much as they did at present. He wished to express the great pleasure with which he had listened to the papers of such a valuable nature which they had heard that morning.

The CHAIRMAN (Mr. St. John Ackers), in summing up the discussion, said with regard to the paper which they had just heard, that of course the great difficulty seemed to him, as Lord Fortescue had pointed out, that the system described in the paper had come so recently into operation, that they could hardly build any theories upon it which were likely to be practical for this country or for any other. One prominent point in the paper was that, instead of having a single examiner, who went round and examined large districts, they apparently had a jury of practical agriculturists; but the author did not say sufficiently how far the members of the jury had had proper and thorough scientific training. However, one could hardly imagine that they would be supposed to be fit for their position unless they had had at least a certain, and we might suppose a sufficient and thorough, scientific training for the particular branches which it was necessary for them to see properly carried out. With regard to the subjects which were taught, it might be noticed that great stress was laid upon arboriculture, which practically was meant not to include arboriculture in its fullest sense, but simply to include the growing of fruit. Nobody who had been to Belgium could fail to notice how admirably the cultivation of fruit was carried on, and the ingenuity with which some sort of structure which would collect the sun's rays was put up, even by the very poorest, for the purpose of getting their fruit ripe and well for early market, for we all knew that the early fruit

and the early everything paid best. In this country, however, we had damper and more precarious weather, and we should therefore probably find that which had been, unfortunately, his experience in a long endeavour to make some profit out of the growth of fruit in this country. It was really exceptional when they could make the growing of fruit pay. He did not mean to say that that was the case with every kind of fruit, for there were certain fruits that would pay very well, but tree fruit, such as was mentioned in the paper. It was very rarely that the seasons which we got in this country were suitable for the production of such fruit; and he believed that that was the great obstacle, far more than any want of intelligence with regard to the management of the culture. That, he believed, was the real reason why so little had been done in this precarious country, for it had been found that those who had put their money in the land for the purpose of cultivating fruit had left the greater part of their money in the land, and unfortunately it had not been recovered. Mr. Dixon had asked some very pertinent questions with regard to the paper. He (the Chairman) wished that there had been somebody present who could have answered them. Lord Fortescue had very properly pointed out the slowness of the agricultural labourer, or, rather, the descendants of several generations of agricultural labourers, to take in abstract ideas. That was a point which he for one, as a breeder of cattle, and one who knew the value of descent, would not dissent from in that room. Far from it; but, on the other hand, he would say that the children of the agricultural labourers, while unable to grasp an abstract idea with the same readiness as children whose parents had had a different education, were capable of being trained, if they were taken in the right way, so as to become very useful men in that branch of life which they intended to follow, namely, agriculture. He was very pleased that some remarks which had been made in the meeting that day by Sir Thomas Dyke Acland, with regard to people who imagined that the agricultural labourer of

this country was a fool. Such people had only to go and talk to the labourer upon his own business to find out how very much more he knew of certain practical points in agriculture than either the educated country gentleman or the scientist, or the doctrinaire who came from a town or from a school to teach, or rather to find fault with the agricultural labourer for the very little knowledge he possessed. He (the Chairman) never spent an hour with any number of agricultural labourers without gaining some good and practical knowledge. Their reasoning powers were admirable for the processes which they had to work out. We ought to be very glad for them to be able to work out those processes. Unfortunately it was now the fact that in England there were very few agricultural labourers such as used to be called "handy men"—men who could take up any branch of farm work. Now-a-days the carter was not a good hedger, or the hedger was not a good man to thatch a rick. It was, of course, very much to be desired that, as they were doing more in the special branches, and taking the whole range of the ordinary agricultural work, that they should have their intelligence increased. He was not saying anything against that, and he thought that there were many ways in which it might be done, but we must start with right ideas. We must not imagine—indeed, we should be very wrong if we were to imagine—that the ordinary agricultural labourer was anything approaching a stupid human being. There was great force in what Mr. Leaver had said, but he thought that it would have come better had he made his remarks upon the early papers rather than upon the paper relating to Belgium. His remarks, however, were very profitable. It was perfectly true that our present education did absolutely unfit boys in country places to become agriculturists; and that, no doubt, was one of the reasons why they sought work elsewhere, to the great detriment of the country, and very often to their own loss. In certain instances, doubtless, it had a very good effect, namely, that it sent them abroad. The clever ones got opportunities of distinguishing

themselves which would not have been otherwise attained; and we very often had the pleasure of finding the intelligent and fairly wealthy man returning to his native village after having left it in early life and having gone abroad or to some far distant part of the country and obtained employment. But we must remember that there is a limit to the profitable employment in all branches and all trades, and if the country is to be denuded year after year of the best of our agricultural population, it would be indeed a very evil day for the production of food-supply in this country and for the political life of the country. With regard to the question whether apprenticeships could not be rather shortened and made less expensive by a more suitable education having been previously given, that, he thought was a point very well worthy of consideration, and one which might without difficulty be fairly worked out.

The Section then adjourned until two o'clock.

On resuming, the chair was taken by Lord LYTTELTON.

STATE AID TO AGRICULTURAL SCIENCE.

By R. H. PAGET, M.P.

IN the Civil Service accounts of last year, as presented to Parliament, it is recorded that, for scientific observations of the Transit of Venus, the sum of £10,000 was expended by the State—and for the Deep Sea Exploring Expedition a sum of about £5,000.

Learned societies figure for some £30,000 more; whilst the sum total spent on Science and Art reached the respectable amount of some £600,000.

For the investigation of agricultural science, there is

scarcely a trace of expenditure in the annual accounts of the nation.

By diligent search, it is to be discovered that, for agricultural schools in Ireland, the State makes the handsome outlay of £2790; and it is remarkable that there is a saving on this vote of some £600, which is significantly said to be due, partly to "the more stringent application of the Board's rules, and partly to the successful working and large receipts of the Albert farms."

In England, I find that "the lecturers in agriculture and mineralogy received £7 11*s*., and £22 2*s*. as assistant examiners in science."

In other countries a very different system is followed. The interesting return, entitled "Reports on the Agricultural Department of Foreign Countries," lately presented to Parliament, at my instance, shows that vast sums are annually expended by different states. In Germany, for the year 1883-4, the estimated expenditure of the Ministry of Agriculture amounts to £482,000. In France, the sum approaches £2,000,000. Denmark votes about £30,000; the Netherlands, some £38,000; and the United States, for the year 1882, spent some £73,000; and so on with others.

Now, I have not one word to say against our national expenditure on science and art.

Collections of the highest interest are formed. Much valuable information is acquired. The observations of the transit of Venus may correct by a million of miles or so the presumed distance of our earth from the sun.

The scientific results of the Challenger expedition reveal to us the physical and biological conditions of the great ocean basins.

The investigation of agricultural science would only assist our toilers of the soil in the production of food for the teeming population of the land.

It could do no more than teach us how best to grow meat, bread, butter, milk, cheese, and fruit.

And so it comes to pass, that, towards the investigation

and the teaching of the oldest, the most universal, the most practical of known sciences, the State contributes practically nothing.

Why is this so?—The reasons are not far to seek. They may be briefly stated thus: I. Though farming is the oldest industry in the known world, scientific agriculture is the most modern of inventions.

II. There is a deep-seated popular belief, that any practical farmer can grow mutton and turnips, and that scientific or theoretical agriculture is all bosh.

III. There is the profound conviction that State aid means State control, red tape, jobbery, paternal Government, and all sorts of horrors—from all of which we ought to pray to be delivered, rather than invoke the assistance of anything which might possibly call any one of them into being. Is there a sufficient answer to these objections? It will scarcely be denied that theoretical teaching of pure agricultural science is a modern invention. Indeed, strictly speaking, agricultural science cannot yet be said to exist; our most intellectual and advanced explorers are avowedly but on the threshold of their labours.

The greatest discoverers of our day, Professor Liebig and Sir John Lawes, would probably be the first to admit that they are, as yet, but groping in the dark, in the pursuit of the unrevealed science of agriculture, an opinion which I venture to predict would be unhesitatingly endorsed by the eminently practical spirit of Dr. Voelcker.

Nature slowly parts with her secrets; she is the most exacting of mistresses, and to nothing short of diligent, methodical, unwearying, careful, scientific enquiry, will she render up an account of the secret hidden springs of her action.

But, it will be said, surely anybody can try a scientific experiment for himself if he pleases?

I answer, it is not so. The so-called scientific experiments of amateurs are generally valueless.

They are often inaccurate, and therefore misleading.

They lapse after a year or two. There is no record of

results—there is no certainty of what has taken place, and, rightly enough, little or no weight is attached to them. "Let me see," says Mr. Smith, proudly pointing to an enquiring friend a fine crop of swedes, "that's the plot where, two years ago, we put double the quantity of sulphate of potash, and left out the magnesia." "Beg your pardon, sir," says the bailiff, "you are thinking of the lower end of Flat Acre, this was dressed with rape-cake and ammonia." "No, no," says Mr. Smith, "I'm sure you're wrong, I've got it down somewhere"—but where? The memorandum can't be found, and of what scientific value are Mr. Smith's experiments?

The truth is, that nothing is more difficult than to carry out properly a series of scientific agricultural experiments.

The initial difficulty is, that not only do they not pay, but they are very costly.

The next important difficulty is, that the laboratory is out of doors, exposed to all the vicissitudes of season, to abnormal heat and unusual cold, to constant downpours or occasional drought, all these circumstances exercising disturbing influences on the growth of plants, and demanding the constant repetition of similar experiments, till you have practically exhausted a cycle, or, better still, several cycles of varying seasons.

A further difficulty consists in the length of time required to demonstrate with certainty the results of any given experiment. In the simplest case you have to wait for several months, till the crop is harvested; but in many cases you have to wait for years, till you have completely exhausted by frequent cropping, some one or other dressing of manure, applied so long since that it would have been long since forgotten, and have had no place whatever in the books of the amateur.

Enough of the difficulties. Let me try to state the necessary conditions to ensure success.

A small farm, compact, well drained, no plot less than one-eighth of an acre; above all thoroughly clean, for "sweet flowers are slow, and weeds make haste," and

nothing can be more worthless than tabulated results of experimental plots foul with weeds.

A careful analysis of the soil of every field.

A careful record of temperature and rainfall, of sunshine and cloud, for a series of damp, dull, sunless days may exercise a vast influence on vegetation when the rain-gauge would have made no record.

Each experiment should have some carefully defined object. It would be well to begin with plots of half an acre or more, as it is often desirable to subdivide a plot, to determine some unexpected question.

Additional land should be occupied, to provide from time to time for fresh experiments, without disturbing those which were being carried on.

This done, and the whole placed under the superintendence of some careful, methodical, accurate observer, who may be thoroughly trusted to record from day to day the history of the farm, to note down every result of success and failure.

To keep his records so tabulated that at any time the exact history of any plot could be followed through all its changes, of season, of cropping, of manuring, and of yield; analyses of its soil being taken at fixed intervals.

Then, by painstaking, assiduous attention for years, avoiding all hasty generalization, all rushing at conclusions, all attempts to realize foregone conclusions, we should gather up rich stores of accurate experience, which could not fail to be of lasting benefit.

But something more is wanting to enable mankind at large to profit by scientific experimental farms.

Their results must be translated into homely words, understanded of the people.

Admirably scientific as are Rothamsted and Woburn, their accounts, bristling with statistics, roam too high in the region of pure science to afford practical information to the ordinary farmer. They want careful dilution and digestion to reduce them to a state in which they will convey clear, definite information of general value. It

would probably conduce to the successful working of the experimental farms I advocate if they were carried on, as that at Woburn, under the immediate superintendence of the Royal Agricultural Society, though, for obvious reasons, they should be placed in different parts of the country, so as to embrace our varying conditions of soil and climate.

Reports should be published from time to time, and widely and gratuitously circulated for general information.

It is, however, constantly maintained that a farmer can't do better than leave theory alone and stick to the practice of the country.

There is a mixture of fallacy and fact in this argument.

It is beyond all doubt that a world of wisdom is carefully stored up in much, if not all, of the practical agriculture of every-day life.

For instance, in following the ordinary four-course system of husbandry, many a farmer is, perhaps unconsciously, applying the principles of the purest Agricultural Science.

Ages of observation and experience have established the value of this system; but we should be in poor case at this moment if we had nothing but the four-course system to depend upon, and if Liebig and Lawes had not shown us the value of organic and mineral superphosphates.

Why should progress stop there?

There are only too many problems of scientific agriculture which require to be solved.

The special value of the clover crop? the source whence it derives its nitrogen? the present impossibility of curing clover sickness by any combination of artificial manures? all these are practical questions.

Take, again, the recent experiments at Woburn, as to the relative manurial values of decorticated cotton-cake and Indian corn. The practical results are strangely opposed to all previous theory; but it is more than probable that further experiments will show that the land has a surfeit of nitrogen, more than it can digest; and that, treated with smaller doses of cotton-cake, it will produce

equally satisfactory results and re-establish the scientific accuracy of the careful estimates of Sir John Lawes.

I have one more foe to slay, in order successfully to maintain my position, that it is the duty of the State to aid in the investigation of Agricultural Science.

People say, "We don't want State interference!" "We'll fight it out for ourselves." "What is the use of all this stuff about science and theory?" "We don't believe in Agricultural Departments." Some may be found who, whilst throwing out dim hints that even the serenely-scientific ether of South Kensington is not absolutely free from some suspicions of self-interest, loudly exclaim, "Leave us alone." "We know best how to manage our own business."

But let us see what happens if they are left alone. There is no spontaneous growth of experimental farms, or experimental stations, which is a phrase sometimes preferred.

If we could create more Dukes of Bedford, and more Sir John Lawes', then, indeed, we could well afford to dispense with State aid; but the fact is, these desirable people do not exist.

Agriculture is slowly emerging from a state of prolonged and exceptional depression and disaster.

It is generally recognised, at last, that trade and manufacture are intimately affected by agricultural difficulties.

Year by year foreign competition in agricultural produce is keener and keener, its maximum has yet to be reached.

If, then, national prosperity hinges on agricultural success, does it not follow that unless some supreme efforts be made to improve our agricultural processes, we may see more land go out of cultivation, fresh disasters to owners, occupiers and tillers of the soil, and the general interests of the mercantile community sharing to the full in all our difficulties?

When foreign art, and taste, and skill successfully invaded our home market, our manufacturers were not slow to demand State aid for technical schools, to enable them to

hold their own. Would it not be worse than folly, that we, inspired by a spirit of extravagant self-reliance, should rather remain an example of "suffering sad humanity," than boldly prefer the reasonable demand that State aid should be given to Agricultural Science?

DISCUSSION.

Mr. ROWLANDSON (Darlington) said this subject was one of very great urgency at the present time to the farmers of this country. He himself commenced as a tenant farmer at the age of eighteen years, two years after leaving school, and had felt the want of further education than that which the sons of farmers received in grammar schools. With regard to teaching agricultural science, he thought it would be necessary for the men to learn the actual working of a farm before attending science lectures, otherwise the man's mind would not be able to appreciate the importance of the teaching which he received. He should first learn the practical work of a farm, for, as a practical farmer himself, he felt that it was absolutely necessary for his future success that he should learn all the details of the work in every department, and be not merely a theoretical, but a practical farmer, because then, in after life, if he were compelled to leave home for a time, the details of the work could be left to the bailiff or foreman, but the farmer would be able to estimate the amount of work which ought to be done during the time he was away; whereas if he were simply a theoretical man, he would be obliged to leave matters entirely to the bailiff. Having learnt thoroughly the practice of agriculture, he would then be able to attend lectures on science, having been to some extent instructed in the use of a laboratory at school, and be able to apply that science to its practical work. It was a question whether these advantages could not be conferred on the farmers by endowments, and not by

seeking for State aid, because when State aid was called in it brought in, to a certain extent, centralisation and State supervision; and it was very questionable, looking to what had been done in other departments, whether it were desirable that this State supervision should be brought in for the education of the farmers. He believed that what was desired might be accomplished by endowed schools, country schools where lectures might be instituted, and where the sons of farmers might get that instruction which they needed. It would be very well also for teachers in National schools to attend those lectures, so that they might be able to instil into the boys of the poorer classes some of those principles which would be of use to them in after life. It would be advantageous also if lectures were given by practical veterinary surgeons, for many farmers would find great advantage if they knew something of veterinary science. Instruction also might be given on the fitting together of agricultural implements by practical workmen, which would enable many farmers to pay much more attention to their tools than they were able to do at present. On the whole, though he saw the necessity for scientific instruction in agriculture, he doubted if it were advisable to call in State aid.

Mr. PACKARD (Ipswich) said it would very ill befit one who had on many occasions endeavoured to advocate the establishment of experimental farms to quarrel with Mr Paget about the way in which he pointed out that object might be carried into effect. He must say he had personally no objection to State aid, but he did object to State control. If they could get the aid without the control, and if the control were in the hands of practical men throughout the country, no doubt great benefit would result. He was firmly persuaded that our Agricultural Societies had not done for the science of agriculture what they might have done, especially the Royal Agricultural Society of England, and it seemed deplorable that in such a country as this the Royal Agricultural Society had, so to speak, to go and ask private individuals to assist them in carrying on

a few ordinary experiments, which ought to have been done by themselves many years ago. Whilst fully appreciating the liberality of gentlemen who came forward in this way, he thought the Societies should look at home and endeavour to help themselves. The Royal Agricultural Society had an income of about £40,000 a year, and yet was not able to spend £400 on agricultural experiments. He could not trace any expenditure on Experimental Farming by that Society excepting the salaries of Dr. Voelcker and those who were engaged with him. Mr. Paget had not committed himself to any definite scheme, but he should prefer to see some scheme promulgated with reference to this question. Mr. Paget seemed to intimate that it would be desirable for the State to contribute to the Royal Agricultural Societies, that they should be the parties to do the work, and if anything in that direction could be done it would be a great advantage. He had also alluded to the size of the experimental plots, and though the discussion, perhaps, ought to go more upon general principles than upon such details, he hoped that measure would be very carefully considered by those who went into this question, because he could foresee difficulties if too large a size of plot were adopted. It was with the greatest difficulty one could procure a sufficiently large area of land over which a long series of experiments could be conducted so as to arrive at perfectly fair results, and if you once commenced experiments on half an acre it might be years before you were able to divert that experiment into any other channel. He hoped that if State aid were obtained the control might be left in the hands of practical agriculturists, and perhaps no better means could be suggested than that the Royal Agricultural Society should administer the fund. What was wanted was not one farm, but many experimental farms in different parts of the country. If they were established they would act as centres from which scientific knowledge would be spread amongst the people in the locality. No doubt if funds were available and men of considerable scientific attain-

ments could be placed in charge of these experimental farms, much good might result.

Mr. T. B. WOODWARD (Tewkesbury) stated he agreed on the whole with Mr. Packard. He should be glad to see State aid given, but not State control; he was in favour of local control, which perhaps might take the form of county control. He would have small farms called experimental farms, and on them an agricultural school, with an administrator who had passed a satisfactory examination in botany and chemistry, and an assistant master who should have passed a satisfactory examination in mechanics; and in connection with that farm he would have a laboratory and workshop. Such schools might be established throughout the whole country, not only for the sons of farmers, but for the sons of the lower middle class generally. Any idea of centralization or central management would be fatal to the success of the natural growth and evolution or development of the entire system.

Mr. CLARE SEWELL READ, M.P., said he agreed, to a great extent, with what had been said by Mr. Rowlandson, for he had great doubts whether Government subsidies, if they were in any way connected with Government interference—and they always were as far as he knew—were really worth having. If they could get the money, and if they had a local distribution of the money, then, perhaps, some good might result, and a very great deal of good. Mr. Rowlandson had referred to lectures, but he had always found a difficulty in a farming district in getting anybody to attend lectures. He did not mean to say they were not desirous of attending, but it was almost impossible to get farmers to drive six, seven, or eight miles to attend a lecture, which in all probability they could read with greater ease by their own fireside in the report presented in the county paper the following week. Therefore he did not think agricultural lectures, unless connected with something practical, something to see, were so interesting or important as a good many people imagined. Then came the question as to experimental farms or stations, and he

thought a multiplicity of them could not fail to do good; they ought to be all over the country on all sorts of soils, for he had been particularly struck with this during the frequent visits he had made to Sir John Bennett Lawes's farm at Rothamsted. There you had a great depth of strong loamy soil resting on chalk, which required no artificial drainage, and appeared to resist any amount of drought. Mr. Paget had said that "Agriculture was slowly emerging from a state of prolonged depression and disaster"; it might be slow, and he hoped it was sure, but if Mr. Paget, during the last three months, had occupied a light-land farm in Norfolk, he thought he would be disposed to say that, instead of emerging from that condition, they were going down deeper and deeper. His experience was they had been nearly burnt up; he had never spent so much money in artificial manures and feeding-stuffs as he had this year, and had never seen so miserable a return for what he had spent. That brought out the point he desired to illustrate, namely, how necessary it was that these experiments should be carried on, not only in different localities, but on different soils and in different climates, and therefore he heard with great satisfaction that the Duke of Bedford had placed at the disposal of the Royal Agricultural Society some light land for the purpose of carrying out experiments. Those experiments, although not carried on many years, had already corrected some errors people were inclined to fall into from the long-continued experiments of Sir John Lawes on one description of soil only, and if similar experiments could be multiplied in different localities, it must produce great good. You could not instruct a practical farmer so well in any other way as through the eye. If he had anything to look at, his mind immediately grasped it, or very nearly grasped it, whereas if he were talked to or written to by the most able men, and in the plainest possible language, it was very doubtful whether he fully comprehended the subject. One of the greatest treats of his life had been his visits to Rothamsted. He had never gone there without carrying

away some impressions that no amount of lectures or of reading could possibly have given him. If, therefore, by the aid of Government subsidies it were possible to multiply these experimental farms, so much the better. He had not the slightest objection to the £600,000 going to Science and Art. Whether that money was properly expended, without the slightest tinge of jobbery or favouritism, he could not say, but he had found, as a rule, that whatever Government did, they did worse than a private individual, worse even than Public Companies—and they did badly enough—and worse even than Agricultural Societies. Still, if there was plunder to be got, he saw no reason why the agriculturists should not ask for some small share of it.

Earl FORTESCUE said he was a consistent repudiator of State aid and State interference whenever it could be done without, but he must say that—not for the purpose of teaching agriculture, which he had the profoundest disbelief in Government doing any good by, but for agricultural research and experiment which were being pursued for the sake of science, and which could not possibly be lucrative, the object being to ascertain facts, not to make money by it—there he thought Government aid might reasonably be given. There was a great establishment kept up at Greenwich, the Royal Observatory, which in one sense paid, because the accurate knowledge of astronomy had a practical bearing on navigation. But from year to year the direct money returns from that establishment were utterly insignificant, whilst the cost was very great. The publications could not be remunerative, because they were so profound as only to be within the grasp of very few people. On the same principle he saw no objection to Government granting money in aid of scientific research, but he had a very great and increasing distrust of Government control. Things started well under the right man, but then, by and by, some man wanted a place, and got it with more regard to his party claims than to his own qualifications—at any rate that was the tendency. So there was only one way in which it seemed to him advantageous to have State aid for

the promotion of pure science—because if the State gave the whole of the money, it ought to inquire how it was spent, and would have to inquire how it was spent, and that way seemed to him to be to give grants to bodies of men or individuals who had contributed largely themselves, and who would enter upon the work for the sake, not of lucre, as was implied by their making personal sacrifices, but for the sake of the scientific information they would obtain. Sir J. B. Lawes had spent so much of his own money, that he might safely be trusted with Government funds. He would not make money out of it, but would only add some of his own to it. He quite agreed further, that they wanted a certain number of experiments tried in a certain number of different soils, and in different climates. But he was rather alarmed at what Mr. Read said about the multiplication of such experiments; it rather reminded him of the phrase *nomen multitudinis*, which they used to use at school, and which implied a great number; whereas he thought a few, under different circumstances and on different soils, would answer the purpose. He should not look upon these stations as centres for agricultural teaching, which he thought would be very undesirable. He did not want the farmers of the neighbourhood only to be instructed in their agriculture; but agricultural research to be carried on, and the results to be published for the benefit of the students and practisers of agriculture generally. For these reasons he quite agreed with Mr. Paget in advocating the judicious expenditure of Government money in encouraging agricultural research and experiments; whilst at the same time he was vehemently against establishing State-founded, State-supported, and State-inspected, farm-schools or establishments, which, however well they might be conducted in the first instance, would in the course of time probably become backward, and would still more probably lead to jobbery and favouritism.

Sir THOMAS ACLAND said he agreed substantially with what had fallen from Mr. Read, and, like him, he never went to Rothamsted without learning some-

thing. A short time ago he took there two farm managers, both thoroughly practical men, and one of them said he had learnt more from the day he spent there than during his whole life. Sir J. B. Lawes had spent £2000 a year, if not £3000, for forty years out of his own pocket, and he had not yet been able, though he had been working hard all the time, to find out the sources of the food of clover. At the same time he had found out many other facts and principles which they might all turn to account if they had education enough and humility enough to distrust their own cleverness, and to confess how very little they knew, and how very much they had to learn. He happened to be a member of the Council of the Bath and West of England Agricultural Society, and at a recent meeting of that society at Maidstone, what had been called the Sussex experiments were mentioned. A member of the Council whom he met there told him that a friend of his had been very successful in growing crops on land in Sussex, which had been thrown on the landlord's hands because no one could make it pay, and that he had succeeded in consequence of receipts for manures prescribed by Professor Jamieson, of Aberdeen. He therefore thought the best thing he could do was to go and see these Sussex experiments; he was not going to give any opinion upon them whatever, but simply state the fact. There was no doubt that experiments were wanted all over England, in the east, in the Midlands, in the Fens, in the grass land of the west, and in the extreme north also; and especially they wanted experiments on the cold Devonian clays which, according to Professor Voelcker, were washed out, and they did not know what to wash into them. For instance, he had land which was not worth 5*s.* an acre, and which nobody knew what to do with, and if an experimental station would tell them, the sooner one was established the better. However, Professor Jamieson had induced some of the Sussex noblemen and gentlemen to raise some £700 a year, out of which he received only a moderate salary for conducting several experimental stations, and he had

published three large reports in which he stated that he had made some discoveries. He had now, he understood, persuaded a Scotch member of Parliament, who occupied an important official position, to let him a farm, and a large sum of money had been raised as capital to work the farm. The landlord went to look at this farm and found the byre, as they call a cattle shed in Scotland, was all boarded round, and when he asked where the cattle were he was told they were not going to have any cattle at all, that it was an experimental laboratory.

However, the discoveries were, as far as he could make out, the result of experiments on spots about as large as that platform. He had made these great discoveries: first of all that turnips required phosphates; secondly, that cereals required nitrogen; and, thirdly, that sulphur, not sulphuric acid, but sulphur absolutely was poison to plants, and the cause of the disease called fingers and toes in turnips. Now Mr. Read knew very well, as well as he did, that phosphates were necessary for turnips and nitrogen for cereals. The controversy between Mr. Lawes and Professor Liebig had taught them all that thirty years ago, and the only question was how cheap they could buy the phosphates and nitrogen, and how they could use them best, therefore that was not much of a discovery. With regard to sulphur he would not say anything, except that farmers had been using superphosphate, dissolved by sulphuric acid, for more than thirty years. Much had been said about the battle of the phosphates, and they were told that in Aberdeenshire certain experiments had proved that the trituration, or, in plain language, grinding of phosphates, was equivalent to dissolving them in sulphuric acid, and that the battle of the phosphates—with a great flourish of trumpets—was conclusively settled, and that it was not worth talking about. He gave no further opinion about it, but he thought country gentlemen as a class wanted a great deal of education, and if the dukes and great landowners in different districts would place at the disposal of competent persons considerable farms, say of 200 or 300

acres, under qualified guides—not the State, not political officials—a great deal of good might be done, but they must take very great care what sort of persons they appointed to advise them, and how the work was carried on.

Mr. S. B. L. DRUCE (Secretary of the Farmers' Club) said the subject of the present paper was, he understood, State aid to Agricultural Research. It was aid to agricultural education, but not aid to teaching young farmers, or boys who were intending to be farmers; it was rather what was known in other educational matters as the endowment of Research. It was Research pure and simple to which the aid of the State should be given, and all who were in any way interested in agriculture must, he thought, be at one on the point, that if possible they should obtain that aid even if there were some State control annexed to it. Although he for one was utterly opposed to anything in the nature of centralisation, and agreed with Lord Fortescue that the most expensive sort of aid was that derived from the State, yet nevertheless a great country like England, a rich country giving, as Mr. Paget had stated, large sums for research in other sciences ought to do something to assist agriculture in the same way. He failed to see why agriculture should be placed in a less advantageous position than science or art, for although strictly speaking it was neither a science nor an art, yet at the same time many sciences and many arts were connected with it: and when a comparatively large sum of public money was given to science and art, he could not see why the farmers should not come in for their share. There was in his opinion one simple reason why State aid should be granted to agricultural research, and that was because agricultural research, to be of any value, must be continuous, and without State aid you could not have that continuity. He said this advisedly, although he knew that it was commonly understood that that wealthy and large-minded man who had done so much for agricultural science, Sir John B. Lawes, had made provision for the continuance of those splendid researches of his after his

death. He believed it was no secret that Sir John had provided in his will for a large sum to be invested in the hands of trustees to continue those researches; but why should this be left to an individual? And there was the possibility of difficulties occurring in the administration of the trust. He had the misfortune to be a barrister practising at the Equity Bar, and his practice showed him how often the intentions of testators were frustrated. He did not pretend to say that the intentions of Sir John Lawes would be frustrated, but there was the possibility of it, and why run that risk? If there were State aid that difficulty at least would be removed. And Rothamsted was really the only experimental farm on any large scale which there had been in England at all until the recent experiments at Woburn. Those, again, were dependent on the Duke of Bedford, who might be taken away to-morrow, and there was no guarantee that the present Marquis of Tavistock would continue them; and even if he did there was no guarantee that his successors would; and, as he had before remarked, continuity in such researches was a *sine qua non.* With regard to the Sussex experiments, to which Sir Thomas Acland had alluded, it was not for him to defend them, but he might say just this much, that at a recent discussion on the same subject at the Farmers' Club in London very similar observations were made to those of Sir Thomas Acland.

Sir THOMAS ACLAND said he had distinctly avoided making any such statements as those to which Mr. Druce referred.

Mr. DRUCE said he was not going to controvert Sir Thomas Acland's opinion, but at that recent meeting he did hear some similar words used with reference to those experiments; and a gentleman then present, Mr. Nicholson, who was directly interested in them, not only defended them and deprecated their being depreciated, but also said that, so far as he and his neighbours in Sussex were concerned—it might be that that part of England was very benighted, even worse than Devonshire—they had derived

much advantage from those experiments. Anticipating that some remarks might be made to-day about the Sussex experiments, he (the speaker) had taken the liberty of inviting both Mr. Nicholson and Professor Jamieson to be present, and he was sorry neither of them was able to accept the invitation. He regretted that out of the many farmers in England who were interested in agricultural education so few had been able to put in an appearance, but no doubt the beautiful weather kept them away, for, *pace* Mr. Read, he believed that in almost all parts of England the weather was better now than it had been since 1874, and they could not blame the farmers for taking advantage of it.

Sir THOMAS ACLAND said his object in referring to the Sussex experiments was simply to induce inquiry into the subject; he gave no opinion as to the value of the experiments. He earnestly wished they were tried in many other parts of England, but he was not yet convinced of the value of the results.

Mr. B. ST. JOHN ACKERS said it was not only the beautiful weather he was afraid which kept the farmers away, but it was, unfortunately, also owing to an unfortunate mistake that notices had not been sent out sufficiently early with regard to the Agricultural Section of the Conference. As one of the officials he begged to say that no pains were spared to insure their being sent out, but accidents would happen, and in this particular case an accident did happen. He most heartily thanked Mr. Paget for reading this instructive paper, which he scarcely thought had met with the full amount of approval which it deserved. He might, perhaps, take exception to the words "agricultural scientific investigation," and so forth, for he considered, with Mr. Acland, who read a paper that morning, that agriculture was not a science; it might be an art, and it certainly was the meeting together of many applied sciences, but it was more accurately described as an art and a business, and it certainly could not be called a science. He must not be taken to depreciate in any way the value of scientific investigation; on the contrary, he

hoped this terrible bugbear—and it was not only a bugbear, but a perfectly natural fear of State help, because of State control—might not prevent them making the just use they could of the help of the State. He would endeavour to make his meaning clear by an illustration. The condition of the arts and manufactures in this country some years ago was such that they were gradually falling behind other countries, especially in those which required a certain amount of skill and artistic excellence. The Nottingham lace industry, for instance, had fallen into such a condition that although the demand for the article was fairly good, it was only good when the patterns were obtained from France. But after the State had granted for so many years (and years were required in all these things) a certain amount of aid to science and art what was the result? The state of the Nottingham trade at the present moment was this:—It was perfectly true that a good many patterns were still sent from France, but the chief designer of those patterns, although he lived in France, was educated at Nottingham under the very system which some speakers had to a certain extent been decrying. Now, if so great an improvement in one important industry had been achieved by State aid, it would be unwise to refuse any State aid because they could not have entire control. If they could show the State that agriculturists could find proper stations and proper persons to carry out the experiments, and then get the State to give grants in aid—in aid distinctly of experiments which required, as all these did, continuity, and continuity for a long period, and they did not depend any longer merely on these spasmodic efforts of great and good men whose hearts were in the work, as they had shown by the sacrifices they had made, men like Sir J. B. Lawes and the Duke of Bedford and others—then he hoped they might be able to get some assistance, and that they might hold in their own hands the maximum local authority with the minimum State interference, but that there must be a minimum of State interference seemed absolutely necessary.

Mr. LLOYD said they were much indebted to Mr. Paget for reading this paper, and when they saw the subject taken up by members of Parliament they might hope it was beginning to attract the attention of those who could carry it into effect; they were also much indebted to him for obtaining the return of what had been done by foreign countries, and showing by comparison how little had been done in England towards advancing agriculture either in science or practice. There could be no doubt that what was really required was for the State to find the means for those who were competent, to obtain knowledge which they did not possess at present; to make investigations which the farmer could not make, and which a scientific man could ill afford to make, unless he were recompensed for his time and the expenditure he was put to. If it could be shown that the whole community were benefited by such experiments—and it could be shown most easily—then it was undoubtedly right for the State to lend her help. Though he did not like to speak of his own work, he might illustrate the advantages of research by a little work of his own. A short time ago he made an investigation into an abstruse point of agricultural chemistry, which he had no idea whatever would be at the time he made it of any general benefit. He was pleased to find it had been of practical value and the paper which he read at the Chemical Society had to be reprinted, and he had since learnt that had not that paper been read, a very considerable amount of the trade between England and America in manures would have passed to France, and we should have lost it, had it not been shown that certain things could be done in the laboratory which before were deemed impracticable, and which our English chemists would not undertake to do. It was done abroad, and was done in America, and consequently dealers in those countries would not enter into contracts with English manufacturers unless it was done in England. It was now done, and the trade had not been lost. He gave that simply as an illustration of how abstruse science might

become of national importance in a manner perfectly undreamed of by the investigator. It was for the State to help the scientific man, not asking him beforehand, Can we be sure that we shall derive some practical benefit from your work? they could not be sure. And that showed the necessity of continuity in all research work, and continuity could only be obtained satisfactorily with—he would not say that it could not be obtained at all without—the aid of the State. Experimental farms and stations had been mentioned, and the difference between the two was perhaps hardly appreciated. An experimental farm proper was merely a farm upon which the produce was grown under definite conditions, from which one might hope to learn definite results; but a station had a laboratory attached to it, in which purely scientific experiments were carried on, these might or might not throw a direct light upon, or be directly connected with, the experiments in the field. Both were wanted; it was not necessary that every experimental farm should have a laboratory, but they did want some stations, such as were found at Rothamsted and at Woburn, although in the latter case the laboratory was in London, and the fields were at Woburn. Having obtained those, then came the question—could competent men be obtained to make use of them, because if they were utilised to spread abroad information which was not absolutely sound, the State would be doing more harm than good; it was because men recognised this that they had been rather slow to advance in the direction, which they all felt was the right one, and for which State aid was demanded. He had been surprised to hear that Mr. Read had not found farmers congregate to hear scientific lectures, for he had been astonished to find what goodly audiences scientific men did get, at least he always got a very fair audience if he went into the country to give a scientific lecture, and he knew that whether or not he had given them useful information, they had given him a great deal. He always felt how difficult it was for a scientific man to comprehend the needs and possibilities, and put

himself in the place of the practical farmer. That was one of the difficulties which science had to contend against in endeavouring to throw light on practical agriculture, and it was necessary before it could be overcome that the State should give the means of doing it, so that there should be a combination of science and practice in the investigation of the problems connected with agriculture.

Mr. LIGGINS said he had had great experience in farming, but it was in the West Indies, and as it was of vast importance to him that it should be properly done, he had taken for the last fifty years every opportunity of acquiring all the scientific information he could so that he might if possible utilise anything which might be of advantage to him. As a matter of principle, he should say if the State could be prevailed upon to devote any portion of the national funds for the purpose of scientific improvement, it would be very desirable to do so if it could be separated from State interference, but his observation of the great technical schools of this country, and he had just left the great establishment at South Kensington, was that nothing could be more unsatisfactory than the technical education there given, and he did not think it desirable that education in any direction should be under dictatorial State management. If they could persuade the Government to give any grant in aid of scientific information it would be desirable, but his own experience taught him that in two great departments, that of agriculture and that of shipbuilding, theory and practice very rarely went hand in hand. He had lost hundreds of pounds in one year by listening to scientific experts and advisers in London in connection with manures which, under their instruction, he had sent to the West Indies. When Peruvian guano was first introduced every one was greatly in favour of stimulating their land by using it, and he shipped £100 worth in one year, the use of which did him thousands of pounds worth of damage. Probably it was unwisely used, for he was afterwards told that it was through its being applied in a dry season; but, unfortunately for him, on that occasion there was no wet season when he could

apply it. On another occasion he was advised to send out nitrates, sulphates, and so forth, and he spared neither trouble nor expense in doing so, but the result was that the money was simply thrown away. To give another instance of quite a different kind. For twenty-five years he had been an associate of the Institute of Naval Architects, where they were inundated with scientific papers, theories and facts, but what did he find? He had asked Sir Edward Reed if he could, on scientific principles, design a yacht that could be placed against one built by the rule of thumb, and his reply was he did not think it would be worth his while to waste time by attempting such a thing. The fact was the only fine vessels of any class in the world were those built by rule of thumb. Therefore it did not always follow that scientific investigation was desirable for practical men, and he did not believe the farmers of England had been such ignoramuses as political writers often represented them, or that they were such fools as not to have acquired a practical knowledge of their work on which their bread depended. Therefore he did not attach so much value to scientific study as many did. Of course it was very desirable, and he would not sever it from either shipbuilding or from agriculture, but his experience showed that it was of very trifling value. Government farms, here and there managed by Government officials, would be one-tenth the value of such farms as those managed by the Duke of Bedford and Sir J. B. Lawes, who had a personal interest and pride in making the success they wished to show their countrymen. He did not believe the land of England was going out of cultivation because the farmers were ignorant and did not know their work, it arose from causes of a very different nature, and if they preferred to have their corn from the backwoods of America, where the land was more fertile, they must submit to the degradation and ruin which was fast coming upon them.

Mr. HUGH CLEMENTS protested against the views put forward by the last speaker as to scientific knowledge, without which all progress was impossible. With regard

to experimental stations he thought too much dread had been manifested of Government control. The farmers would still be free agents, and could carry on their own work in their own way, but if they could induce the Government to support experimental farms it would be a great advantage. Hitherto Government had refused on principle; they spent £600,000 a year on science and art, but a great portion of this was devoted to sciences which were subsidiary to agriculture, and if farmers would not take advantage of them, that was no fault of the Government. It had been said that morning that farmers did not take advantage of these agricultural classes, and if that were so it was their own fault. However, they ought to try to improve the teaching and make it more practical; the landlords of England had acted very nobly, and carried out a large number of improvements, and if they would combine together and establish stations of their own on the principle of co-operation they need not wait for the Government. It would be all very well if the Government would do so, and the more the better, but the landlords had the money and could do it. The way in which Government might very fairly be asked to assist, however, was by giving the use of Crown lands, which would entail hardly any expense, and, in fact, if the farms were well managed they might pay their expenses altogether. All foreign governments were doing this sort of thing, and in Ireland model farms had been established and had been productive of very great benefit. The Glassnevin Institution of Dublin had been very useful, and a similar farm in England would also be of great benefit, especially if it were near South Kensington, so that the teachers of agriculture might take their pupils to see the work going on.

The CHAIRMAN (Lord Lyttelton) said it appeared to him that there was a good deal of unanimity with regard to the question introduced by Mr. Paget, subject to one or two limitations. No doubt Mr. Liggins had introduced an element of discord which he was not sorry to see, because after

all there was nothing like discussion and disputation for the extraction of truth; but he must say the subjects he introduced were of so important and startling a character that he rather wished they had been put before the Section in a separate paper, so that they might have been adequately discussed. But a rather obvious answer to part of what he advanced was supplied by himself, when he said he was not in favour of teaching in agricultural colleges and schools, because they had not taught him how to apply guano and nitrates in the West Indies. But that was no part of an English college course; the conditions were absolutely different in the West Indies, and he could not say that part of Mr. Liggins's speech at all carried conviction to his mind. The limitations he should suggest to Mr. Paget's proposals would be these: The first was with respect to the word science, which was not the right word to use, being rather too wide, and therefore he should prefer that they should resolve to ask for aid to agricultural "research," using the word in a purely scientific sense. The other point on which he confessed to feeling some doubt himself, and as to which some doubt had been expressed by the meeting, was as to whether the aid to be given should be State aid. He himself had considerable doubt about it, and he did not think Mr. Paget had given full weight to the chief objection to State aid. That objection came from a somewhat narrow school, but at all events a very powerful school of economists, who said that agriculture was—like cotton spinning, or any other industry—one of the great industries of the country, and ought to look out for itself without State aid. That was the answer with which they were usually met, and which he thought would make it hopeless to expect any very large subsidy from the State towards this purpose. He said very large, because it was already the case that a certain amount of money was set aside for the endowment of research, and he did not believe there was anything to prevent a subsidy being given by the State at the present moment to purely scientific agricultural research, but he did not think the amount would be a large one if they got it,

probably it would be a mere pittance. Still the principle to that extent had been conceded. But as for getting a large Parliamentary vote for the carrying on of experimental farms and stations, he thought they must dismiss that at once as impracticable. He was rather inclined to agree with Mr. Read, that if there was to be some plunder they might as well get their share, but he was rather surprised to hear so experienced a parliamentary tactician as Mr. Read put the matter in so very bald a form; it was a very old saying that it was in vain to spread the snare in sight of any bird, and he feared the jealous guardians of the Treasury would be put more on their guard than they were already by what Mr. Read had said. He would not add anything more on that part of the subject, but that was the kind of limitation he was inclined to place on Mr. Paget's proposals, that the aid should not necessarily be State aid. At the same time it could not be expected to come from the body of tenant farmers themselves; they had too much to do, too little time on their hands, and, he was sorry to say, they had too little money. It was impossible, therefore, to expect that these scientific investigations could be carried on by the farmers themselves, they must come from somewhere outside. To that extent they were all in harmony with Mr. Paget, but the source to which he should look for assistance had been indicated by Mr. Packard, and he agreed with him that it was a reproach to the great agricultural societies of this kingdom that they had not done more in this direction. Their revenues were very large, they were an exceedingly powerful body, and it had always struck him as a deplorable fact that so little, practically hardly anything, had been done in the way of subsidising agricultural research by these societies. They represented the whole body of the agricultural interest, and they were not yet so absolutely ruined that they could say they could not find the money for this object. Until that was proved the onus ought to be cast on those Societies who were at the present moment the best representatives of the great agricultural interest. With regard to the stations it was suggested should be formed,

he fully agreed that they should be fairly numerous, and represent the various soils and climate of England. Mr. Read had given an admirable illustration of the necessity for that when he complained of the grievous state of affairs in Norfolk, whereas in Warwick and Worcestershire, which were not so very far distant, he believed they were generally satisfied with the season, so far as it had gone, and so far from having too little rain, if anything they had had too much. That showed what an enormous variety of climate there was in this small island. In conclusion, he proposed a cordial vote of thanks to Mr. Paget for his very able paper.

Mr. PAGET, M.P., in reply, said the Chairman had expressed his entire agreement with the paper, with two limitations; the first of these referred to the title, and there he agreed with him in preferring the phrase "State Aid to Agricultural Scientific Research"; but with regard to the second limitation he must place himself in an attitude of friendly hostility. The Chairman said the State would meet them with the remark, that agriculture, after all, was a national industry which must take care of itself in the same way as cotton-spinning in Manchester; but it had been admitted that the Nottingham lacemen had to come to the State and ask for aid to establish technical schools, to place them in a position to acquire artistic skill, by which alone they could hold their market; and other great industries, when they found themselves in these straits, did not hesitate for a moment to demand that the State should come in and furnish schools to give that education which would enable them to hold their own. Who could wander through the rooms full of examples of the art-work of South Kensington in that great Exhibition, without feeling that that Institution was doing a great work? Who paid for South Kensington? The State. And who got the benefit? Certainly not the farmers. The farmers had as much right to State aid in the technical teaching of agricultural science as the Nottingham lace-makers for their trade. It was true they got what the Chairman called "a

pittance," but he was not satisfied with that pittance. Those who took an interest in the land, and all were interested in it, for if they once began to define who were the classes interested in agriculture, it would be found that they spread far and wide, and included hosts of people who at first sight would seem to have but the smallest direct interest in it; and looking at that great industry, and those who were interested directly and indirectly in it, they had a right to demand that they should have not a mere pittance, but that, if the work they were going to do was good work, that work should be done, and the State should not hesitate to find the funds for it. The Chairman asked whether the farmers could not do it themselves? He answered no. Woburn and Rothamsted existed solely by the liberality of private owners, while the Sussex experiments, to which farmers had contributed, appeared to be of doubtful value. He was sorry Sir Thomas Acland had left, for he had referred to State control, the horrors of centralisation, and the poverty of the results which would accrue if any scientific farms were managed by the State; but here was an example of a school with which the State had nothing to do, and yet it was plainly hinted, if not broadly stated, that this private venture of landlords, farmers, and noble lords, and others interested in scientific agriculture, had produced results of little or no value, had only taught them something they knew before, and that all the rest of its teaching was problematical. On that point, therefore, he did not think he had quite the worst of the argument. He knew that centralisation was objectionable to most men, but he did not see why, if there were a scientific farm established here and there in different parts of England, that need entail centralisation. It was no more centralisation than spending £10,000 to observe the transit of Venus; neither would it be centralisation to ascertain whence came the nitrogen produced by a clover crop. One was as purely scientific research as the other, and entirely free from all kind of centralisation. He was rejoiced to hear Sir Thomas Acland say that he never

went to Rothamsted without learning something, and that he realised the enormous value to a farmer of being able to see with his own eyes what was going on. They all knew how true this was. In their leisure moments they read books of travel, and formed pictures in their own minds of foreign lands, but if the fates ever took them to those lands to see them with their own eyes, how different were the impressions produced, and how much more indelible. Who was there who had once been abroad who did not carry home with him, to retain for the rest of his life, so long as memory lasted, pictures which never would be erased from his mind, which were ten times more vivid than anything conveyed by books. It was that practical teaching of the eye that those farms which he advocated would give. Mr. Read rather doubted the value of lectures. He had had but little experience of them, but it was his fortune some years ago to take the chair at Wells when a lecture was given by Professor Buckmaster, and all he could say was, that the room was crammed with people whom he knew to be practical farmers, who listened with the greatest attention, and the only dissatisfaction he heard was, that the moment the lecture was over Mr. Buckmaster was obliged to go away to catch his train, and was unable to reply to the many questions which those present desired to put to him. In suggesting that these experimental farms might be worked through the medium of the Royal Agricultural Society, he by no means wished to say that there were not other Agricultural Societies who might also assist in the work; he merely mentioned the Royal because it had already undertaken this work at Woburn, where the business of the farm was carried on at the expense of the Duke of Bedford, but it was under the control and management of the Royal Agricultural Society and Dr. Voelcker. As to the scope of the work to be done, no one in that room could doubt it was large enough to afford ample field for experiment. To give one example: The value of fallows was to this day a moot question. It was a matter of doubt whether the

land was actually benefited by lying fallow or by a continual system of cropping. Sir John Lawes had made a most interesting series of experiments on this point, alternating fallow with wheat on the same land for years, and growing wheat continuously on the same kind of land for years. In conclusion, he had every reason to be satisfied with the discussion, for it appeared to him every one admitted the need of these farms, and all acknowledged they had not got them. They all knew that in every other country in the world the State provided them, and as people did not come forward to provide them, where, in the name of fate, were you to get them, unless you demanded, as you had a right to demand, the State to come in and aid in this agricultural scientific research.

Mr. C. S. READ wished to say in explanation that he did not at all desire to undervalue lectures. He only said that you could not expect farmers, after a long day's work, to drive six or eight miles to the market-town to attend a lecture very often, although they might go once or twice in the year.

The CHAIRMAN here said he should be obliged to leave, and would ask Mr. St. John Ackers to take the Chair.

Mr. PAGET, M.P., then moved a vote of thanks to Lord Lyttelton, which was seconded by Mr. Read, and carried unanimously.

Mr. ST. JOHN ACKERS then took the chair.

The following paper by the Rev. J. B. McClellan was read by Professor Harker :—

ON THE HIGHER TEACHING OF AGRICULTURE.

By the Rev. JOHN B. McCLELLAN, M.A.,

Principal of the Royal Agricultural College, Cirencester, and late Fellow of Trinity College, Cambridge.

THE special title selected by the Committee of the International Conference for the present paper is itself one of many gratifying evidences of the increasing interest taken by our own and other countries in the question of systematic agricultural teaching for the higher classes of Agriculturists. Agriculture—using the term, as I shall do throughout this paper, in its wide sense, as extending its range, after the theme of the poet of the Georgics,

> " —— super arvorum cultu pecorumque
> Et super arboribus,"
>
> (Geo. iv. 560, 1.)

and embracing various departments of Rural Economy—Agriculture, in this sense of the word, being one of the most ancient and necessary arts and industries, and one of the chief foundations of national wealth and prosperity, there has not been wanting, either in ancient or modern times, together with ample reasons for its earnest pursuit, a supply of prudential and practical precepts (" *veterum præcepta* ") for its successful exercise. And these precepts, however unsystematic and empirical, have been sufficient to admonish successive generations of men that the rewards of husbandry are not to be expected by the careless or uninstructed practitioner.

But it is only in very recent times, from the force of circumstances and conditions unexperienced by our forefathers, that the conviction has become firmly rooted that, for the continued success of Agriculture and the preservation of the material prosperity of the classes more directly asso-

ciated with its enterprise, a course of instruction for its management and operations, its direction and labours, is not the requirement of its humbler train of dependants only, the peasants and the yeomen, the hinds and the bailiffs; nor, again, of its higher *employés* only, the agents, the stewards, the legal advisers; but also, in their proper spheres and degrees, of the highest ranks and classes charged with its responsibilities and maintained by its revenues—the landed proprietors and large occupiers, the eldest sons and younger sons who may succeed to ownership or occupation, or seek their fortunes on the soils of the far West—in a word, all who are summed up in the common phrase "The Landed Interest."

Hallam, in treating of the state of society in the Middle Ages, frequently refers to the almost unlimited control exercised by the landed aristocracy over the progress of agricultural improvement; and on one occasion, while censuring their excessive passion for the sports of the field, makes the caustic observation that "they had not yet learned to sacrifice their pleasures to their avarice" (*Middle Ages*, vol. iii. p. 312). But of late years a more painful lesson has been learnt, and the instinct of self-preservation has been the teacher:—the sacrifice of pleasure to the daily needs of life, and the maintenance of position. Political and social progress; the advancing claims of labour; the apparent deterioration of nature's kindliness and bounty; the devastations of disease in animal and plant life; the competition of old and new foreign countries in the supply of food, through inventions of science which have brought all lands near and made the world itself almost one country;—all these causes have contributed to the diminution of the returns, and of the value of the returns of the landowners and occupiers, and are compelling them, and will compel them even more inexorably, to consider, not the satisfaction of luxury, but the provision of competence. And in dealing with the problem of the amelioration of the depressed condition of Agriculture in this country, which has become one of vital interest and not

admitting of postponement, it is natural that this question of the *higher teaching* of Agriculture, and the *special education* of the higher ranks of Agriculturists, should have been forced to the front, and that astonishment should have at length found wide and public expression that, speaking generally, the occupants of these ranks, unlike the *alumni* of other professions and industries, should have sought and received almost every kind of education and learning but that which was specifically indicated by their future pursuits and future duties. For no monopolies, no indulgences, no bounties, no protections, can long maintain the prosperity of an industry whose *directors* are destitute of the scientific and practical knowledge needed for its intelligent prosecution. The Augustan poet compassionated the misery of such destitution,—

"ignaros viæ miseratus agrestes;"

the pen of the modern satirist has stigmatised its folly. It is Cowley who two centuries ago records that divers considerations of the utility and delight of Agriculture made himself "fall into the wonder and complaint of Columella, how it should come to pass that all arts or sciences, and even fencing, dancing, cookery, carving, and all such vanities, should all have public schools and masters, and yet we should never see or hear of any man who took upon him the profession of teaching this so pleasant, so virtuous, so profitable, so honourable, so necessary an art. . . . Yet who is there," he asks, "among our gentry that does not entertain a dancing-master for his children, as soon as they can walk? But did ever any father provide a tutor for his son to instruct him betimes in the nature and improvements of that land which he intended to leave him?" Now in our own times Cowley's reproach has been partially done away; but it remains to wipe it out entirely, by the provision that every man who aspires to the possession and management or occupation of landed property shall receive the special training which has at length been systematised and brought within his reach. And, as will

be seen hereafter, such a determination will not interfere either with the earlier training of our public schools, or with the later training, where desired, of our old Universities.

The classes, then, for whose special wants our higher teaching is required being as above described, the next points for consideration are the scope of the teaching, the subjects to be embraced, the methods to be employed, the time to be occupied, and the nature of the Institution best adapted to supply it.

As a preliminary safeguard, it will be useful to dispel the pernicious mists which have gathered over the whole area of sound agricultural teaching through the strong prejudice which exists in the minds of practical men against all "theory." Agricultural science is *not* "theory"; and with "theory" the scientific agriculturist has little or no concern. He recognises that Agriculture is emphatically a *practical* thing, and that all the teaching of agriculture, whether higher or lower, must have for its object its utility and success *as such*, or be foreign to his purpose. "*Sine successu ac bono eventu, frustratio est, non cultura.*" But he also recognises that of this art, as of other most practical arts, as navigation, engineering, medicine, there is necessarily a science; and that for this art to attain the zenith of prosperity and weather the periodic storms of adverse fortune it must be pursued and developed in accordance with its own verified laws—laws, which, making the case the more vital, are not those of one single and isolated science, but those of a combination of many allied and inter-penetrating sciences, whose several *facts* and *principles* condition the whole of his practical operations. Nor can any amount of self-delusion or self-will impair this conclusion. For although in this as in other arts, practice has historically and naturally preceded science, yet the connection between it and these sciences is simply inevitable, a part of the *leges æternaque fœdera* of nature, against which all struggling is vain. And when the self-taught and self-styled "practical" man conducts, as he has done in the past and may do, though

probably to a much smaller extent, in the future, a successful business under a given set of accustomed conditions, he is unwittingly but actually employing and reaping the fruit of accumulated stores of science—*facts* and *laws*—which he and his fellows have acquired and inherited through the costly experience of themselves and their ancestors. Such success, however, is local, temporary, and precarious; and there can be no reasonable doubt that, to be practically masters of the position, so far as human power may avail, and to be competent (as is desirable) to prosecute research, and, by discovery or judicious adoption of discoveries, to conduct the art to further economies and conquests, the higher agriculturists must be men equipped to face and triumph over all changes of condition of locality, season, and rivalry; men whose trained observation and diligence shall be capable of noting and recording the multitudinous facts affecting their industry, whose disciplined judgment can infer and appreciate at their right value the principles which are ever active to aid or thwart their labours, and whose cultivated abilities and skill can securely apply them. Thus, though it may sound paradoxical, they will be most thoroughly *practical* men, because they are *educated* and *scientific* men; and, as has been excellently remarked, "the supposed monopoly of *practical* knowledge by the unread agriculturist will be found to be purely imaginary, a creed invented by himself, and the very opposite of the truth." (Mr. Wren Hoskyns, 'Cyclop. Agr.' i. 731.)

What then, after thus clearing the way, are the special subjects and sciences which, in their proper measure, are to be insisted upon for the higher agricultural teaching? The field is a vast one, and there is no royal road to it or over it, for either owner, agent, or occupier:—

——"Pater ipse colendi
Haud facilem esse viam voluit."

Take first, as generally obvious and the *raison d'être* of the rest, the extensive range of agricultural practice. Keeping in view the different kinds and objects of husbandry—

arable, grazing, dairying, and mixed—the teaching must include the qualities and requirements of soils, the indications of their impoverishment and methods of improvement; the properties, treatment, application, and value of manures, natural and artificial; the comparative advantages and disadvantages and management of implements and machines for field and barn, whether of hand, horse, water, or steam power; labour and wages (for I have no time to enter into details); buildings, fences, and sanitary expedients. It must further include the different systems of cultivation appropriate to heavy and light lands, and their mechanical operations; the choice of rotations and culture of the various crops from tillage to in-gathering, according to local peculiarities of soil and climate—

> ——" patrios cultusque habitusque locorum,
> Et quid quæque ferat regio et quid quæque recuset;"
> (Geo. i. 52, 3.)

the variations of vegetable and fruit-farming; the management of grass lands, with the laying down and improvement of pastures; the kinds and due proportion of live-stock, with the critical selection of individuals, and the breeding, and rearing, and general management of flock and herd, summer and winter—points, like so many others of perpetual interest, noticed of old by Virgil, and on which he admirably turns to practical account the country gentleman's love of field sports (Geo. iii. 72, sqq.)—the systems of dairy-farming and dairying; the phenomena of the diseases and injuries of crops and animals, with practical measures of avoidance and treatment; the account keeping, and all the general business of the Farm and the home and foreign Markets.

Passing from the Farm to the Estate, the teaching must include the general management of landed property; the estimation of condition and value; the laying-out and improvement of farms and reclamation of wastes; the management and utilization of woods and plantations, with the necessary forestry operations; the duties and qualifi-

cations of the various officers; the tenancies, valuations, repairs, accounts, involving (as on the farm also) the elementary principles and practice of *Book-keeping.* By an easy transition, the rights and liabilities of landlords and tenants, agents and servants, as to one another, their lands, and their live-stock, introduce various branches of *Agricultural Law.* Similarly, the erection and maintenance of the farm buildings call for some special teaching in *Plan* and *Design Drawing,* on the nature and properties and cost of *Building Materials,* and the methods and specifications and estimates of *Building Construction.* And, again, the various measurements and surveys required on the farm and the estate, the laying out of lands, construction of roads, water supply and storage, drainage and irrigation works, and (looking at the not improbable wants of the colonist) other practical undertakings; these introduce the subjects of *Mensuration, Land Surveying* and *Levelling,* and other branches of *Practical Engineering,* which in their turn imply a previous knowledge of *Arithmetical, Geometrical,* and *Trigonometrical* principles.

The most practical man will have little or no difficulty in agreeing to the outline so far, or even in casting a glance at the *history* of Agriculture in this country, and at the special features of the great American, Indian, and Colonial Agricultures.*

But now a further step is to be taken—a step into the domains of science—and I hope to carry conviction to his mind that the step is expedient for his practical ends. If I may be forgiven for applying a famous phrase, I will say that Agricultural Science is a "British interest;" none the less worthy of the protection and advocacy of the rich and powerful because it is a peaceful one. I pass by, for my present argument, all the value of science as a mental discipline and as an education in habits of exactness,

* With regard to India, I take the opportunity of commending to public notice a brochure of unusual interest and value just published by Mr. Syed Muhammad Hussain, at present one of the Indian students at the Royal Agricultural College, Cirencester.

patience, and perseverance, which, nevertheless, are all qualities of acknowledged practical worth. I am simply about to present to the agriculturist the knowledge of the principles of certain particular sciences as one of his highest practical interests, a power by whose agency he will be spared many a useless and disheartening expenditure, and guided through many a weary labyrinth, a necessary factor of his desired business success. And, from this point of view, I submit that the following sciences—all, however, within certain limits, not *propter se*, but because of and to the extent of their practical bearings on the agricultural industry, and to be taught in a special way—justify and demand their inclusion in a sound system of higher agricultural teaching, viz. :—Chemistry, Geology and Mineralogy, Botany, Zoology and Animal Physiology, Physics (including Mechanics), and Veterinary Medicine and Surgery. If I pass over Logic and Political Economy, sensible as I am of the great practical value to the agriculturist of some of these topics, it is because at present, having regard to the amount of time generally at disposal for learning, there seems little opportunity for their study.

Of the other mentioned sciences every reflecting agriculturist, after the investigations of Sir H. Davy, De Saussure, and Liebig, and with the living testimonies of Boussingault and Wolff, Lawes and Gilbert and Voelcker, admit the prime importance of *Chemistry*—the science which, whether we regard the organic life or the dead matter with which we have to deal (I am speaking popularly, for truth would rather be expressed by a conversion of the ancient maxim of Heraclitus, *πάντα ῥεῖ*, into *πάντα ζῇ*, *universal flux* into *universal life*), permeates our other sciences, and goes down to the very depths of our most perplexing inquiries. Let me quote the words of one of our greatest living philosophers, Mr. Herbert Spencer, who (although as if the statement may create surprise) observes: "In these times even agriculture, to be profitably carried on, must have like guidance of science. The analysis of manures and soils; the disclosure of their respective adaptations; the

use of gypsum or other substances for fixing ammonia; the utilisation of coprolites; the production of artificial manures—all these are boons of chemistry, which it behoves the farmers to be acquainted with" ('On Education,' p. 17). Mr. Spencer's list might easily have been extended; for, of all the natural sciences, none has been so immediately fruitful in practical results, and there is none that inspires so many well-grounded anticipations of further benefits from the investigation of problems still awaiting solution. This science will explain the properties, actions, and uses of the mixtures and compounds with which our art is practically concerned in the air above and in the soil beneath, through all the intricate processes of nutrition and growth, maturity and decay, in crop and beast; exhibiting and discovering, by the unfolding of its facts, and laws, and methods, as they are intelligently grasped, sound measures, old and new, for the renovation of deteriorated soils; for the supply, and preservation, and economy of foods; and for the earlier and more perfect attainment of health and vigour in the plants and live-stock; indicating methods of improvement in the production of the raw materials, from plant and animal, for the mill and loom; detecting impurities and unfitness in waters, and adulterations in purchased commodities; revealing the conditions affecting the special products and manufactures of the dairy and other husbandries; and warning against vain and fallacious experiments. These, and such like, are the liberal contributions of Chemical Science to practical agriculture; and Rothamsted and Woburn, and the R. A. S. E., and the experience of every county, vouch for their value.

The next sciences are scarcely of less practical moment. *Geology*, (not losing sight of *Physical Geography* and *Mineralogy*,) dealing with the arrangement of the rock masses, and the situation, relative position, composition, and characteristics of the rocks which form the crust of the earth, and from which are mainly derived the materials of our soils and subsoils, will throw useful and necessary light upon the diversities of soils and the differing agricul-

tural characters and capabilities of districts on the several geological formations; will disclose the mineral wealth or poverty of particular neighbourhoods, the presence or absence of industrial materials valuable for proprietory uses or commerce, as building stones, slates, mineral fertilizers, and many others; will indicate the best directions for drainage, and best sites for well-sinking, with the difficulties to be expected and overcome in these and such-like operations, and the errors to be avoided; and thus render services whose value it is difficult to over-estimate in the selection of properties and occupations, and for the purposes of tillage, valuation, and improvement of estates, security of investments and outlays, and other practical objects of the landowner or occupier at home and of the colonist abroad.

Proceeding to the *Biological Sciences*, I will cite again the words of the author of the 'Synthetic Philosophy:' "With the all-essential manufacture—that of food Biology is inseparably connected. As agriculture must conform its methods to the phenomena of vegetable and animal life, it follows that the science of those phenomena is the rational basis of agriculture. Various biological truths have indeed been empirically established and acted upon by farmers, while yet there has been no conception of them as a science; such as that particular manures are suited to particular plants; that crops of certain kinds unfit the soil for other crops; that horses cannot do good work on poor food; that such and such diseases of cattle and sheep are caused by such and such conditions. And as these biological facts, scanty, indefinite, rudimentary, though they are, aid the agriculturist so essentially; judge what must be the value to him of such facts when they become positive, definite, and exhaustive." And he instances, for example, of debts which agriculturists already owe to Biology, the saving of fodder by keeping cattle warm, the assistance of digestion by a variety of food; the recovery of sheep from "the staggers" [the "gid" or "sturdy" is meant,] by the removal of the entozoon [the brain-hydatid], now known to cause the disorder ('Educ.'

pp. 19, 20). The practical value of the recent discoveries in regard to the life-history of the liver-fluke is in the mind of every one. These Sciences, then, will familiarise the agriculturist with the organic structure and function of all those plants and animals which it is the very essence of his business to produce and rear, revealing to him the laws of the biological processes of growth and reproduction, and the conditions favourably or prejudicially affecting them, and thus suggesting methods whereby these laws and conditions may be utilised or modified for his greater advantage and profit.

Botany—to take the one great division of these Sciences—will specially explain the characters, habits, and uses of our agricultural and economic plants. As a result it will enable the agriculturist to recognise and distinguish with accuracy the several kinds (many of which, as the grasses and leguminosæ, present great difficulties of determination), and will assist him accordingly to the choice and cultivation of suitable species, and to the rejection of such as are unsuitable or noxious. In the experimental work which he will undertake, it will acquaint him with the conditions which favour the production of healthy seed plants, the phenomena of fertilisation, and the establishing of new varieties by careful breeding and selection, as also with other means of influencing nature in his behalf. Horticulture and Arboriculture will share in the advantages. But I should add that the acquaintance with Vegetable Physiology involved in a knowledge of the processes of plant-life will presume some teaching of Histology and Microscopic Manipulation.

Turning to the other division: *Zoology*, with *Animal Physiology*, will explain the habits and characters of the agriculturally important species of animals, and especially the anatomical structure and physiological processes of the animals of the farm, the differences between good and bad formations, the normal appearances of the various parts, the data for determining age, and the various functions of digestion, circulation, respiration, work, &c. It will thus

lay a sound foundation for a knowledge of the principles and practice of breeding, feeding, and fattening; of the conditions most favourable to any specially desired results, such as early maturity, or the economical production of milk, meat, or wool; and of appropriate measures for the treatment of disease — of which more hereafter. And although the experience of our own country is happily free from such devastations as those of the locust and phylloxera of other lands, yet our annual loss from the ravages of insect and worm pests is so serious and harassing that the branches of Economic Entomology and Helminthology will be welcomed as most material allies in explaining the development and action of the marauding insect groups, with the nature and life-histories of the parasitic scourges of field and stall, and in indicating methods of mitigation of the injuries and sufferings inflicted by their attacks.

At this stage, in connection with Zoology and Animal Physiology, may conveniently be considered the claims of *Veterinary Medicine.* But just as it is not the object of our higher teaching to qualify the agriculturist as a professed Zoologist or a professed Botanist or Geologist, so neither is it contemplated, or indeed practicable, to train him as for the Veterinary profession. It would be mischievous folly to encourage him to neglect the services of the professional surgeon. But cases are of every-day occurrence in the agriculturist's experience, especially on stock-breeding and dairy farms, when, with the anatomical and physiological knowledge already acquired, an elementary but (so far as it goes) a sound knowledge of the principles and practice of Veterinary medicine will fully meet the circumstances, and others in which, as a temporary expedient, it will suffice to save many a valuable animal till professional assistance can be obtained. The hygiene of the stable and the yard, the treatment of the females during gestation and in and after parturition; the nature of the common veterinary ailments, the changes which the morbid processes induce in the animal economy, and the symptoms by which they are characterised, with the simple

rules of diagnosis; the general principles to be promptly followed in acute diseases, as in the early stages of fevers, poisoning, choking, or various accidents, pending the arrival of the veterinary expert; the dieting and nursing of the sick animals, and administration of ordinary medicines; simple operations, and the bandaging and dressing of wounds: these are all points within the scope of the practical agriculturist, and of large pecuniary value to himself and his locality; the more so if he be a colonist, or otherwise far removed from extraneous aid.

But there is one class of diseases on which, by reason of the terrible rapidity and extent of their diffusion, and the enormous losses sustained by a community through their severity, sound teaching is of special importance, and which it is desirable to single out for special comment: I mean the *contagious* and *infectious* diseases of live stock. An acquaintance with their symptoms, with the means and channels by which they are usually spread, with the conditions on which their very existence depends, will enable the owner to guard against their invasion, and, in case of outbreak, to put in practice without delay the necessary remedial measures, and intelligently to co-operate with the administration of law. And if, as must often be the case, the agriculturist be called upon, in the capacity of Magistrate or Member of the Legislature, to assist in devising or carrying out fresh protective legislation, he will be thus much better qualified for his task.

The remaining science to be included in our scheme was that of *Physics*. To equip or improve the estate or holding, the agriculturist undertakes preliminary operations in which a want of knowledge of the controlling physical laws is fatal to his success—as those, already mentioned, connected with water supply and storage, and the all-important works of sewage and drainage. To save time and labour, alike in these and in his other mechanical operations, and to render himself more independent of the caprice of circumstance, he employs machinery, which it behoves him wisely to select as to form and capability, and rightly to manage and pre-

serve in fit condition for use. Ignorance of the principles of such machinery results in the purchase of inefficient implements, manufactured for sale rather than for work, or in the attempted performance of tasks with instruments never designed for their execution. Disappointment, breakage, and heavy loss follow. It is an evident gain, therefore, for the practical agriculturist to understand the nature and laws of the physical forces which counteract where they do not assist his efforts; and to be able to turn to his advantage their mode of action. Thus, the principles of mechanics in regard to the application and equilibrium of forces, and the strength and stability of structures, the mechanical powers, and their economic applications; the fundamental properties of fluids, laws of fluid pressure and motion, and utilisation of their energy; the construction and action of the common hydraulic and pneumatic machines, water-wheels, turbines, pumps, and others; the effects of heat on solid, liquid, and gaseous matter, with the laws of combustion; the formation and properties of vapours, with special regard to steam, and the application of this form of energy to the construction and working of steam engines specially modified for agricultural purposes; the general laws of meteorology and climatology, and use of instruments, relating to atmospheric temperature, moisture, rainfall, and other phenomena,

> "ventos et varium cœli prædiscere morem,"
> (Geo. i. 51.)

as affecting the agricultural and sanitary character of districts, and, according to changes of season or climate, modifying agricultural treatment: a knowledge of these matters, to go no further, is, I repeat, a clear economical gain, and cannot be neglected without grave peril. Considering, moreover, the physical and physiological effects of light and electricity, and the brilliant future that seems to be in store for the energy of electric currents even in regard to agriculture, there is sound reason for including

teaching on the nature and laws of these forces also, and their practical applications.

I trust I have now said enough, however briefly and imperfectly, to convince the practical agriculturist in the higher walks of the profession in our own country—for on the continent of Europe on the one side, and in America on the other, he has long been convinced already—of the great advantages that must accrue to him from an education which includes in its curriculum the above mentioned portions of science, and to excite serious reflection on the utter unreasonableness of the expectation of any general and continued success of Agriculture without such teaching.

I proceed, therefore (and, literally, in a very few words), to explain the appropriate method of this training, its duration and cost, and the time of life at which it should be undergone. Those who have followed me thus far will probably be prepared to share my conclusion, that the only satisfactory method is by the combination of a special COLLEGE with a well-equipped and well-conducted FARM. It is essential that the COLLEGE be specially organised and well-officered by a special Professoriate and teaching Staff, having a good knowledge of the practical applications of their respective departments, and qualified for extending them. In conformity with its express practical aims, it must be liberally furnished, in addition to its class rooms and library, with practical laboratories, museum well supplied with illustrative collections, herbarium, botanic garden and experimental plots, with (if possible) nurseries, plantations and forest within convenient reach, with veterinary hospital for the treatment of diseased and injured stock, and for *post-mortem* examinations and dissections, and with workshops of practical carpentry, smithwork, and such like. There should be apparatus, diagrams, working models, and samples, without stint; and the whole teaching, while unfolding the facts and principles of the included sciences, must be emphatically distinguished by its *practical character and exercise*, the daily lessons in the *laboratory*,

garden, *field*, and *farm*, being made co-ordinate with and fixing those of the class-rooms. On this feature it is impossible to lay too much stress. It is that which will at once distinguish it from the old methods of theoretical science, and alone give it its incontestable and permanent value to the practical man.

Before passing from the College, need I apologise, if, in regard to an intended country life, I add a word here for the higher physical recreations, recalling the traditional fame of the district in which the first Agricultural College of this country was founded, in the well-known lines—

> "The Cotswold with the Olympic vies
> In manly games and goodly exercise"?

The FARM—which, for greater general utility, should be a good mixed arable and grass farm, of from 400 to 600 acres or upwards, in preference to a dairy farm—must be firmly attached to and in proximity to the College. The business management need not necessarily be in the hands of the College or a direct charge upon its time and capital: in fact, on the contrary, there are weighty reasons for rather entrusting the tenancy and direction to a well educated independent capitalist, whose energies can be concentrated upon its special business as a concern that is to be worked to "pay." But in either event—and on this I lay emphasis—there must be equally reserved to the College full rights of use of the farm and its operations for all purposes of practical instruction by the teachers and the students, involving access at all times, inspection and instruction in routine and all details, participation (if desired, though not compulsory) in the manual labours, and exhibition of the accounts; and it is expedient that the bailiff or superintendent of the farm be one of the practical instructors on the college staff. For the supplement of dairying—as the farm is to be a mixed arable and grass farm—provision should and can easily be made in vacations or afterwards by a few weeks' stay on a good dairy farm or dairy manufactory; and it will be an ad-

ditional benefit, if, as the secretary of the Royal Agricultural Society of England has recommended in his valuable Report to the Royal Commissioners on Technical Instruction, opportunity be similarly taken for a sojourn at the works of one or more of our best firms of implement and machine makers for the details of machine construction.

The general method, then, being admitted, where can it be realised? Clearly not by home experience, nor by mere apprenticeship on a farm or an estate. Instruction and discipline alike preclude these. But the Universities have been thought of. I think it will be evident that neither can it be realised at the Universities. The establishment of one or two professorial chairs at these ancient seats of learning—which is the most that could be hoped for; as the one so ably filled at Oxford by Dr. Gilbert—falls almost infinitely short of the imperative demands of the case. Putting the Farm out of the question, I believe it would be absolutely impossible and inconsistent with the character and objects of our Universities for them to attempt to supply these demands, either in regard to the theatre of operations or as regards the agencies of instruction. The demands are too special and too practical. But special Colleges of Agriculture, in suitable districts, on such a basis as I have described, *can* meet these demands. Cirencester itself is evidence that what the Universities attain for their distinct ends, and what the Military, and Naval, and Engineering Colleges attain for their respective professions, such Colleges can attain for the higher teaching of Agriculture, mentally and morally, socially and professionally. And if, as agricultural institutions on the Continent and in America, and as the Universities and various technical colleges at home, they received the support of private or public benefactions—and I venture earnestly to petition for both—they would be able to exercise a still wider and more beneficial influence upon Agriculture, as Schools of Art have done upon our manufacturing industries.

The course of instruction cannot occupy less than *two years*, whether the intention be agriculture at home or agri-

culture in the colonies. The principles are everywhere the same: and a mere "session or two" at a college is a thoughtless and delusive proposal. Nor can the cost, unless by benefactions, be less than about £150 per annum, if board and lodging be included, or about half that sum without them.

The age for admission should be at the least *eighteen* years, when the full benefits of public school life and training have been already received, and the bodily and mental faculties are sufficiently ripe for the special studies. Beyond that period there need be no limit of age. The course could be taken, in many cases possibly with even still greater advantage, later in life (provided no season of idleness had intervened), and either without or after a University course, as circumstances might determine. For many country gentlemen and others desiring to engage in agriculture prefer, and will continue to prefer, to have the advantages of a University career also. It is further desirable, in the case of intending agents and owners, that upon the expiration of the college course, there should be a further pupilage of a full year or more with a competent agent on a well-managed estate, in order to learn the management of men, and the details of office routine, and to gain experience. In the case of an intending occupier or colonist a year might similarly be taken on another farm in the selected district; but this is not so necessary. Such a training, from first to last, would not occupy more years than are commonly spent in preparing for various other professions which are yet of less general importance, have fewer difficulties to encounter, and in which less capital is at stake.

I have thus endeavoured to point out the *classes* for which an agricultural teaching of the highest order is needed and designed, the extent of its *subject-matter*, its *method*, and the nature of the *institution* by which the task can be most efficiently discharged. Incidentally I have also endeavoured to draw public attention to the anomaly and unwisdom of Agriculture still remaining to a large extent a

profession and business for which the higher classes occupied in its practice receive no special training for their functions. On the other hand, I am deeply sensible that no amount of acquired knowledge will command the highest success in so complex an industry without natural aptitude and keen watchfulness and diligence, which will grasp small details in their ever varying aspect, estimate probabilities and, whilst observant of the many social and political phenomena which affect its operations, as by opening or closing markets, and stimulating or discouraging particular products, will continue research and study through life. But the training I have sketched, aided by the enterprise and capital of our countrymen, and the blessing of Him who alone "giveth the increase," offers a reasonable hope, that, even with a single generation of our youth so equipped, and

"patiens operum exiguoque adsueta,"

the parched fields of our industry may revive, the distresses of past years be repaired, and Agriculture again become not only one of the most honourable and pleasurable professions, but one of the most remunerative.

DISCUSSION.

Mr. T. B. WOODWARD said it was impossible to say much with regard to a paper containing so much matter without having time previously to read and digest it, and any observations he could make would certainly not do justice to the author. He must congratulate Mr. M'Clellan for having put forward a very important idea, perhaps the central idea of the paper, which had not occurred to him before. They had heard a great deal of late about associating rural enterprise, in the way of agricultural research, with the Royal Agricultural Society of England; but it appeared to him that the principal idea put forward in this paper was that when a sound and complete system of agri-

cultural education was established throughout the whole of England, those intermediary schools should be affiliated with agricultural colleges. The curriculum of studies laid down in the paper was for a man who was to come out at the top of the tree, either for a professor or first-rate agriculturist; for there were no less than eight or ten sciences for him to study, and naturally chemistry stood in the foreground, and they all knew, directly they became acquainted with the real nature of things, they came face to face with the laws of chemistry. Perhaps Professor Harker could say whether this was the idea that these schools, the agricultural schools, should be affiliated with an agricultural college. If they were, and were conducted on sound scientific principles, it would be a grand thing for England.

Professor TOWNSHEND, of Ohio State University, said he had listened to this paper with very great pleasure, and if it were printed in one of their reports in Ohio, it would give great satisfaction to his friends there; and he was quite sure they would agree that it came up to the times. A great deal of discussion which he had heard in that Section reminded him of what he would have heard in Ohio a generation ago; but this paper seemed to come up to present wants, and was just what he expected to find it when he saw the name of the author.

Mr. CLEMENTS said he was rather struck with the number of Latin quotations in this paper, which were far more than he had ever seen in any agricultural paper before, though perhaps it was not to be surprised at from a gentleman of Mr. M'Clellan's university reputation. He stated that those who owned land—the great landlords—ought to really learn their business, which it was well known at the present time they did not, though he believed on the Continent, in Germany and France, the large landowners—who were not so numerous as they were in this country—did study agriculture more thoroughly. Those who entrusted their affairs to others never got on so well as those who were able to look after their own business. Another point was the precarious nature of

farming; but he believed after some time it would not be so precarious as it had been, for that it would be possible in the future, from a careful study of the sciences, to say absolutely what the seasons would be. He had devoted the whole of his spare time to this subject since June twelvemonth, and he believed he should be able to tell what years would be wet and dry, and that he could demonstrate it to any one present; and not only the years but the wet months. He had published this statement, and brought it before the Royal Meteorological and other learned Societies, but no one expressed an opinion, and now he had sent it to Washington, Paris, and Berlin, because it really depended on scientific principles, on the fact that the moon controlled the weather to about 90 per cent. And he believed that in future farmers would have more control over the operations of farming, that there would not be any such years of depression as 1878 and 1879 for another eighteen years. He had gone back seventy years, and he found that it held true in every case up to the present time. The paper hardly bore out its title, because it was rather a curriculum of study than a discussion of the mode of teaching. He mentioned various sciences which were connected with agriculture, and he believed a great many of those could be taught in an elementary form at school; in fact, they were taught now, not only in London, but to a greater extent in Birmingham, Manchester, and Liverpool. Animal physiology was taught in Belgium to boys in school, and if you set them to make a section of an animal in any particular part they would do so, representing every organ in the animal. Now if this could be done in Belgium it could be done in England. Farmers were often at a great disadvantage for not knowing the constitution of the animals they reared. Prevention was better than cure, and a little more physiological knowledge would often enable them to prevent the outbreak of disease. The Conference on Dairy Farms had given the farmers a good deal of information on dairy management, which was of great importance, for too many farmers were accustomed to work

mainly by rule of thumb. It was a very great drawback, in dairy work particularly, that questions of temperature were not strictly attended to by the aid of a thermometer.

The CHAIRMAN (Mr. St. John Ackers) said the discussion on this paper was by no means commensurate with the value of the paper itself, but it simply arose from the pressure of circumstances. It had been intended that it should form the first paper to be read on the following morning; but as Professor Harker was obliged to leave town that evening, it was thought better to read it so that he might be able to reply to anything which was said. There were only two points on which he would venture to touch; one was with regard to veterinary knowledge. He had the advantage of living in the country, not very far from Cirencester, and he believed it was a general feeling amongst agriculturalists in that neighbourhood that the general education of veterinary surgeons might, with advantage to themselves as well as the community, be greatly improved. At the present time there was a great want of attention being given, both to the structure of the bodies and the diseases of animals on the farm, such as was given to those of the human body. He was rather surprised to hear the model farm described as being part arable and part grass, and therefore not a dairy-farm; on this point he thought the author was a little behind the times, for there were those now who contended that the best dairy-farms were those which had a very considerable portion of arable land upon them. Without giving any opinion whether that was so or not, they all knew that there was a large undertaking on hand at the present time with regard to such a farm in the County of Sussex, which was started by the gentlemen who so ably started and conducted with such success the Aylesbury Dairy Company in London; and he held that even in this country it was a very great advantage in a dairy-farm that a considerable portion—at least half, if not more—should be arable. If that were the case, it would very much help to solve that problem which they had all heard so much of, namely, how to make arable farming at the present time—

he would not say more profitable, but less unprofitable—a less heavy burden than it had been for many years. The only other point in the paper on which he would say a word was towards the end, where the author said the course might be taken with still greater advantage later in life, provided no season of idleness had intervened. Now, with all due deference to the head of so great an establishment, he was one of those who held that, given the capability, the time and the opportunity, which very rarely occurred, a year or more of so-called idleness between the hard work of the school or university career and the taking up of the practical side of country life was by no means a bad thing; for those who were able to spend a year in idleness, not of a bad sort, but of a recreative sort, were much more able to appreciate and digest what they learnt at such a college as Cirencester, where there was so honest and so difficult a curriculum to go through. He hoped he should not be considered too heretical, but he did hold that very strongly, for some of the most successful men in life he had known were those who, from some cause or other, were unable to continue their studies at that critical time of life. In conclusion, he must propose a hearty vote of thanks to Professor Harker for reading the paper.

Professor HARKER, in reply to a question put by Mr. Woodward as to the affiliation of lower schools, said that, provided agriculture were taught in any systematic manner in those lower schools, they might hope that at some future period scholarships would be established to be held at their college for the best students at those schools. If there were a number of schools of any kind established for teaching the sciences connected with agriculture, they hoped that the most diligent students who passed the best examination or showed the greatest capacity for going on further might be assisted by an endowment of some kind to come to the college. That also furnished, to a certain extent, an answer to the question raised by another gentleman, who rather objected that the paper was a mere

enumeration of subjects to be taught. It did go much further than that, because special allusion was made to the laboratories, museums, the work in the botanical garden, in the field, and on the farm, and it detailed the most effective modes of carrying out the study of the particular subjects enumerated. It was quite true that many of those subjects, if not all, might be taught in elementary schools; the majority of their students came from the great public schools; they generally had a number of students from Eton, Rugby, and Harrow, all coming with an excellent elementary knowledge of most of the subjects, and they were most delighted that they should so come, because they could then pursue their studies with much greater advantage. A man who wanted to make himself a master of agricultural chemistry could not do that in two years; but if he had been previously four or five years at a school, where he had learnt some amount of elementary chemistry, he was all the better equipped, and all the better able, to avail himself of the instruction conveyed. So far, therefore, from appearing to depreciate the teaching of these subjects in elementary schools, they would only be too delighted that all students should have that amount of previous training. Before a man could take a diploma in agricultural chemistry at their college, he had to spend thirty hours a week in the laboratory in analysing cakes and soils, so that he could not come to college with too much knowledge of chemistry or any other subject. He thought he need not apologise for the Latin quotations, especially when they were from the works of probably the greatest agriculturists—or certainly the greatest men who were agriculturists—who ever lived; the names of Virgil and Varro were quite sufficient to excuse the quotations. He might perhaps say one word in answer to some questions which had been raised before, as to the importance of applying State aid to experimental farms. Where could you find in the world a better place for an experimental farm than at such a college as Cirencester, where they had a practical chemist on the spot, with two or three

assistants, a botanist, two professors of agriculture, who had been trained as agriculturists practically, and who were themselves farmers of eminence.

In reply to the Chairman he would say that their principal difficulty about dairy-farming was that it could not very well be managed in connection with the college, and they thought it was decidedly better, on the whole, for the students to have, as the College had, a mixed farm; and they had near them dairy-farms, to which the students were able to go for a fortnight or three weeks; and many of them in the vacation spent a longer time at a large dairy-farm, and there they got instruction in details supplementary to the principles of dairying in which they were well grounded at Cirencester. He did not object to some time of idleness if well spent; in fact, as a rule, most of the students who came from the universities did generally spend some months of a long vacation on the Continent before coming to the college.

TEACHING OF AGRICULTURE.

FRIDAY, AUGUST 8, 10 A.M.

Chairman: Mr. B. ST. JOHN ACKERS.

PROFESSOR WRIGHTSON, of the College of Agriculture, Downton, before proceeding to read a paper on the Higher Teaching of Agriculture, stated that he had been engaged in the work of the higher agricultural education for twenty years, and did not speak with the slightest feeling of egotism when he said that he had given his life to that particular work and had taken the very greatest interest in it. He did not speak on this subject after having merely dabbled in it, nor did he speak as an amateur. The principles which were embodied in his paper he was prepared to defend, and he believed that they were the only sound ones with reference to higher agricultural education. He noticed that in Professor M'Clellan's able paper, read on the preceding day, a large portion of the argument was devoted to a somewhat elaborate defence of scientific teaching in the lecture-room. That paper could not be regarded as an apology, but still the subjects of biology, zoology, botany, and other sciences were brought before the Conference, and the utility of them to the agriculturist was defended. This was a very large subject, and one upon which persons who had special means of experience had made up their minds. Some persons, no doubt, considered that scientific instruction was not of importance to the agriculturist. Others considered that a knowledge of agriculture was inseparable from a know-

ledge of chemistry, biology, and other *ologies*. These two classes of persons would probably hold their opinions, and the time of the Conference would be somewhat wasted in discussing the large issue as to whether scientific knowledge was absolutely necessary for the successful cultivation of the ground. He considered that a discussion of that kind was somewhat fruitless, and was not likely to lead to any definite result. He would rather not discuss the great issue as to the utility of scientific instruction to the farmer, but if they took up those excellent reports of the Commissioners of Technical Instruction they would find that throughout the European and American world there was a most perfect consensus of opinion, and a most absolute agreement with reference to the necessity of scientific knowledge in connection with industrial art. Whether they looked at the work of a school for weaving, or at the work of a school for wood-carving, or at the work of a school for brewing, in every case the sciences had formed an important part in the teaching. There was no examining body either in Europe or America which did not insist upon the sciences. There was no high education which did not give its sanction to them; and he affirmed that it was almost necessary in an agricultural school or college that they should at all events accept that dictum, and that they should teach science and teach it with regard to agriculture.

AGRICULTURAL EDUCATION.

By JOHN WRIGHTSON, M.R.A.C., F.C.S.,

President of the College of Agriculture, Downton; Lecturer in the Normal School of Science; Examiner in Agriculture for the Science and Art Department.

THE complete and correct instruction of the cultivators of the soil in the theory and practice of their art is a problem of first-rate national importance, the precise meaning of which is only imperfectly understood. Every one is in-

terested in it, and every one believes it in some way or other to be a fine thing. Nevertheless, there is no doubt that the progress of technical education in agriculture has been hindered by widespread misconception as to its legitimate aims and objects; and also as to how those aims and objects are to be obtained. These two questions ought to be answered before we can recommend any practical measures or any measures likely to command success.

At a Conference of this nature we should be able to sift out the true objects of technical education in agriculture, and to indicate to the public how these objects ought to be carried out practically. I venture to draw the attention of the Conference to the following points which, taken consecutively, lead up to this result:—

1. What agriculture is.

2. What agriculture includes.

3. To what extent is scientific teaching of agriculture applicable to the three agricultural classes—Landlords, Tenants, and Labourers.

4. What subjects form a complete curriculum of agricultural knowledge.

5. What means can we suggest for furthering the cause of technical education in agriculture.

WHAT AGRICULTURE IS.

Agriculture is an art, not a science. Mr. H. M. Jenkins, after a long experience, says, "In my opinion agriculture is not a science, but an application of several sciences to a particular purpose, namely, the cultivation of the soil; therefore, it is an industrial art. The business of the agriculturist is more extensive, as it includes the hiring of land, the buying and selling of produce, and so forth." In this I concur, but I go further. Why not include the owning of land, the letting and valuing of land, the erection of farm buildings, the drainage and improvement of land, the making of roads, and a vast

number of branches of knowledge relating to man, to animals, to plants, to implements, to soils, to manures, to foods, to taxation, to legal enactments, to values, to quantities, to climate. I once found myself in a controversy with an unknown opponent as to whether "farming" was an equivalent for the word "agriculture." I am bound to allow that the latter is the more comprehensive word. A farmer is a cultivator of plants and animals, and also may in a limited sense be termed an agriculturist. But if I were to specialise terms I should define an agriculturist as one capable to taking comprehensive views upon agricultural topics in their relations not only to his own farm, but to the commonwealth. Many excellent farmers do not come up to this standard of an agriculturist. On the other hand many of our best agriculturists have not farmed. It is not necessary to think of Arthur Young, Sir John Sinclair, John Grey, or Sir James Caird as actually farming. Apart from any such considerations, we see in each of them an agriculturist. While, therefore, farming is agriculture, agriculture is not farming—but more—and it is by noticing this distinction that I am able to present you with a wider view as to what constitutes agriculture. It includes not only the operations which tax the endurance of the labourer and the skill of the farmer; but those problems which exercise the ability of the mechanician, the chemist, the experienced land agent; and which by their difficulty and complexity engage the political economist and baffle the statesman.

What Agriculture Includes.

Springing naturally from what has been already advanced, we notice the following sections to be included under the general heading of Agriculture.

1. Knowledge pertaining to soils.
2. Knowledge pertaining to plants and animals.
3. Knowledge of mechanisms.
4. Knowledge of construction.
5. Knowledge of fertilisers.

6. Knowledge of nutrients.
7. Knowledge of economics.
8. Knowledge of business.
9. Knowledge of law.
10. Knowledge of meteorology.

Reducing these various kinds of knowledge to terms usually accepted as representing them, we find the following sciences all bearing upon Agriculture :—

1. Geology.
2. Biology.
3. Engineering and Mechanics.
4. Drawing and Architecture.
5. Chemistry.
6. Rural and Political Economy.
7. Commercial Knowledge and Book-keeping.
8. Law.
9. Meteorology.

To each of these sciences I should prefer to prefix the word "Agricultural," and to speak of Agricultural Geology, Agricultural Biology, and Agricultural Chemistry. We ought to be able to relegate every agricultural fact to one or other of these sciences, and I believe it would be possible to do so.

One more subject has, however, to be added. It is the central topic around which all the others range themselves—the nave around which the other parts of the wheel rotate, or the tire which binds them into one compact whole. It is the ART which they all unite together to explain and to improve. It is the thing itself which they are summoned to illustrate. Without it the whole faculty loses cohesion and falls to pieces. It is "Agriculture" as a subject. The points of contact are manifold, and the dovetailing is endless; but for all that Agriculture is not chemistry, and it is not botany, geology, or meteorology. It is not any of these. It is Agriculture. Just as navigation is not mathematics, just as engineering is not mechanics, just as surgery is not anatomy, or just as music is not acoustics, so and similarly Agriculture is not the

sciences which touch it. This is a most important principle to keep in view, because it has not been acted upon. The subject of Agriculture has been lost in a maze of chemical, geological, botanical, and other facts, and the agricultural teacher has been thrust upon the world as a shallow dabbler in a dozen sciences, contemptible to men of science, and destitute of actual knowledge of Agriculture as it is known to those who practise it.

Agriculture is an *Art.* It is the business by which the majority of the human race sustain themselves. Like all arts, it has a theory, and it is in the theory of agriculture that we find its relationship to science. But unfortunately the theory of agriculture has been separated from many of those subjects which are of the highest importance to agriculturists, and focussed upon topics in which his interest is somewhat languid. A scientific knowledge of agriculture does not *only* include the molecular, microscopic, chemical, and entomological facts bearing upon it. And yet the so-called "Principles of Agriculture" has been too often, nay, generally, considered as consisting of these molecular and minute enquiries. Agriculture has, in a word, been treated as a science. It has been called a science, and in a certain slack or colloquial sense it may be so spoken of. This idea has, however, been mischievous, and has thrown agriculturists out of sympathy with agricultural education. We must endeavour to look at agriculture AS IT IS. And we must not forget its vast importance.

The subject of AGRICULTURE viewed as a distinct study comprises the following sections, which must be separately taught:—

1. The history of agriculture.
2. The various processes and appliances employed in carrying out the entire management of soil, crops, and animals, with their products — agricultural technology.
3. Comparative agriculture.
4. Labour.
5. Buildings, roads, and fences.

6. Economics.

It is only by recognising agriculture itself as a subject, apart from the "ologies" which surround it, that we can escape from the confusion into which we have fallen, and redeem the teaching of agriculture from the suspicion with which it is viewed. As examiner in the subject of agriculture, I find that the so-called agricultural instruction now being imparted in science schools in this country is not agriculture at all, but agricultural chemistry, and that not of the best quality. Under the head of principles of agriculture there is also a certain amount of instruction given in agricultural geology, physiology, botany, &c., but I look in vain for knowledge of agriculture in the sense in which I regard it. The fault is not in the syllabus of the Science and Art Department, but in the state of knowledge of the teachers. Questions upon the origin and composition of soils asked by the examiners for the department are answered. Questions upon the *indications* of fertility in soils, upon the *improvement* of soils, the *management* of soils, rotations of crops, principles of breeding animals, varieties of cultivated plants, farm machinery, farm buildings, land cultivation, &c., are either left unanswered or are so answered as to show complete ignorance of the subject. I hold here the syllabus of the Science and Art Department, in which all the above matters are enumerated, but a fatal pottering over "dormant and active" constituents of soils, functions of ferric-salts in the soil, action of lime on organic matter in the soil, formation of "double silicates," &c., appears to have *possessed* science teachers who have taken up the subject of agriculture to the exclusion of all matters which really interest farmers. I have laid stress upon this point because I look upon the efforts of the Science and Art Department as of the utmost value, and as earnest of still greater benefits. The syllabus is excellent, and is often revised. The questions asked at the May examinations cover an extensive field of agricultural knowledge, but the subject throughout the country is evidently

treated upon narrower lines, and as though the great subject of agriculture was merely to be regarded through the spectacles of an agricultural scientist.

To what extent is Scientific Teaching of Agriculture applicable to the wants of Landlords, Tenants, and Labourers?

The time allowed me is too short to enlarge upon this topic. Every man must learn his business, and it is highly desirable that he should learn it in the best possible manner available. It is, however, of vast importance that the teaching should be *good, applicable*, and *practical*. It should be our object to make a farmer, not a chemist of the youth, and to treat all the sciences connected with agriculture as subsidiary to this main object. It becomes, therefore, essential that the technical education of a young farmer should be based upon practical instruction in the field, and that sufficient scientific knowledge should be given to illuminate and render intelligent the processes thus noticed.

This view is thoroughly in accord with my own method of teaching agriculture. Theory and practice must go hand in hand together if sound knowledge is to be attained. Few persons now doubt the value of technical instruction to landlords and farmers, but there is another class that require it fully as much. I refer to the labourers. It has long been my opinion that the labourer has become a serious obstacle in the way of agricultural improvement. Every practical agriculturist knows the importance of carrying his labourers with him in any projected alteration of processes. It is of importance that bailiffs, dairymen, shepherds, ploughmen and labourers should at least make an effort to give a new method a fair trial. It is certainly in their power to frustrate or greatly impede the good intentions of an energetic master, and I know cases in which they have done so. The old plans are invariably preferred, and mines of ignorance and strongholds of stub-

bornness are at times revealed which astonish and perplex their discoverers.

Farmers are well known to be somewhat sluggish in their appreciation of technical education. This is due to the following causes. First, that they see the hollowness of agricultural teaching as ordinarily set before them. I have already expressed my opinion on this subject and need not refer to it at length. Farmers are entirely out of sympathy with the pseudo-chemical explanations vouchsafed them, and the echo of their own experience translated into scientific jargon. They either laugh at it, or regard it as something completely above them, and all very well for "gentleman farmers;" or as an indication of knowing very little about farming business. Secondly, farmers believe that their sons can learn agriculture better at home. Thirdly, it is very expensive, and sometimes leads to extravagant management. Landlords, land-agents and the higher classes of the community have shown the strongest appreciation of sound agricultural teaching. They have chiefly supported the two agricultural colleges of Cirencester and Downton, in both of which Institutions agriculture is distinctly taught with good illustrations, and scientific instruction imparted by well qualified professors.

SUBJECTS WHICH FORM A COMPLETE CURRICULUM OF AGRICULTURAL KNOWLEDGE.

This section has been to some extent anticipated. The syllabuses of the Royal Agricultural Society of England; of the Highland and Agricultural Society of Scotland; of the Institution of Surveys, and of every agricultural college in Europe, in the United States, the United Kingdom, all agree. The unanimity is in fact perfect. The unanimous opinion is in favour of a combination of practical instruction upon the land with the study of the natural sciences both abstract and applied to agriculture. The list of subjects may be thus summarized:

Agriculture.	Materia Medica.
Chemistry.	Meteorology.
Geology.	Mathematics.
Botany.	Surveying and Mensuration.
Zoology.	Estate Management.
Physics.	Book-keeping.
Anatomy.	Drawing.
Physiology.	Building.
Therapeutics.	Forestry.

Experience proves the necessity of teaching the sciences first elementarily and secondly technically, or with a view to their direct application. Thus much work is thrown upon the agricultural staff in preparing their students for the reception of applied science. It is a matter of great regret that these sciences are not more generally taught in schools, so that students might at once enter upon them with the prefix "agricultural" attached to each. Instead of in this desirable condition, youths arrive at agricultural colleges not only ignorant of the elements of science but of mathematics, and the foundation requires to be laid when the technical knowledge ought to be imparted. The question then presents itself to the mind of the student whether these sciences are going to be of any use to him in life. This question would never be asked if the elements of them had been imparted as an integral part of elementary and general education. The student would at once be able to proceed to study agricultural chemistry, the nature of the soil, the grasses, diseases of stock, &c., instead of having to wade through the terminology and technicalities of these sciences. That a knowledge of these sciences is essential to the right understanding of agriculture cannot be doubted, but when a student has arrived at an age at which time has become an element of importance, he chafes under the study of the elements of subjects which he wishes only to know for a special object. A student of my own when introduced into the chemical laboratory and given the usual introductory exercise, went up to the Professor and said, "I

don't want to do this sort of work, I want to learn to analyse a soil." "All right, there's a soil,' said the Professor. Discomfiture of the student. It is absolutely necessary to go through the drudgery, but it is a matter of regret that seldom, indeed, does a student present himself who has overcome these preliminary difficulties, and is prepared to at once proceed to the agricultural aspect of the sciences in question.

What means can we Suggest for furthering the Cause of Technical Education in Agriculture?

I must, without preface, and as briefly as possible, make a few remarks upon this my last section. First then, I could wish that boys intended for agricultural pursuits could be so trained in the elements of science that they might at once proceed to apply themselves to the technical study of these sciences in connection with agriculture.

The demand for high-class instruction has hitherto been fairly met, and the complaint appears to be that few candidates present themselves for the various scholarships, and other honours, offered for competition by the several examining bodies.

The demand for second-class schools, suitable for the training of smaller farmers' sons and bailiffs, requires to be created, as it does not appear to exist at present to any considerable degree. It has been suggested by Dr. Merriman, that there should be attached to a certain number of suitable schools, farms of proper size and character, and that suitable additions should be made to the teaching staff for the purpose of teaching the advanced boys the practice and the theory of agriculture. It is recommended by Mr. Jenkins, in his capacity of an Assistant-Commissioner on the Royal Commission on Technical Education, that "it would be most desirable that the Government should give annually a free scholarship, available for either the Normal School of Science, of Cirencester, or Downton, or any future

College of that class, to the head pupil in the final examination of the agricultural division of each (such) school." This appears to be a very feasible suggestion towards the solution of this part of the subject. With regard to the lower education, the only machinery at present is that of the Science and Art Department. This organization is excellent, and capable of extension; but I cordially agree with Mr. Jenkins, when he says, "In England I simply recommend that the Government should place 'Agriculture' on at least an equal footing with 'Science' and 'Art.'" But the chief difficulty is, after all, in the supply of teachers. The qualification is too low, and the teachers apparently rely entirely upon text-books, which are utterly inadequate to the requirements of the subject. This is the true difficulty, and the Government qualification for teaching agriculture requires to be raised very much indeed.

If the remuneration is too small to attract talent, the Government might cause the circulation of such comprehensive text-books, agricultural catechisms, and lists of agricultural books, as would ensure a fairly comprehensive knowledge of the subject in candidates. These could be used by teachers, and the result would be undoubtedly most excellent. I am also personally in favour of making agriculture a school subject in rural districts, and I would suggest that Primers should be produced, giving good, sound knowledge upon agricultural matters. It would, however, be highly desirable that such information should deal with the subject as a reality, and in the manner in which it will present itself to the young people in actual practice, and not deal with matters chiefly hypothetical.

Mr. St. John Ackers resigned the chair in favour of Earl Fortescue.

DISCUSSION.

Mr. W. C. TAYLOR (School of Agriculture, Aspatria, Carlisle) said that he had been exceedingly delighted with the paper, and it only became him in offering a few remarks to say what they had been trying to do in the North with regard to the practical education of young men or youths destined to be farmers. Some years ago a want was felt by the farmers in that neighbourhood of an education, and especially a technical education, for their sons. This caused them to form among themselves a kind of society which would provide a school where youths from fifteen to twenty years of age might have daily practice upon their farms in addition to the science teaching in their schools. This they had carried out, and he was happy to say that lately it had met with somewhat a large success. They had carried out, indeed, the suggestions of Professor Wrightson, and also those which appeared in the report of Mr. Jenkins, where it was suggested that the farm attached to the schools should be carried on by farmers who were endeavouring to make farming pay. This was carried out now by two farmers, Mr. Norman, who was formerly a student at Cirencester, and also by Mr. Twentyman. They were both directors of the school, and they took such a lively interest in it, that they caused every boy to be daily under their personal supervision, and they saw to the carrying out of the operations of the farm to their satisfaction. This consequently enabled the boys to have somewhat of a practical knowledge for their after-life. Many boys attending the school were the sons of farmers, and consequently naturally and intuitively knew what the work was. But the subject of farming was growing. Interest in the school was very rapidly increasing on the part of the sons of gentlemen of the upper middle classes, men who wished their sons to take perhaps an active life in the colonies. And many boys had gone from the school and established

themselves either on colonial farms or at home. He might remark that some time ago he received a letter from a practical farmer at Longtown, named Graham. He informed him that the result of the teaching that was given to boys who had been at the college was that they went about their work understanding it, and did it in a much more workmanlike way than their elder brothers did who had been all their life on the farm, because those who had been to the college had taken in the science of the work as well as the practical part; and the motto of the college, and one which they endeavoured to carry out, was "science with practice."

Mr. CLEMENTS said that there were several points to which he should like to refer, in Mr. Wrightson's valuable paper. He might say without hesitation that it was the best paper which he had heard read for a long time at any agricultural meeting. He might say that he always agreed with everything which Mr. Wrightson had brought forward, but it seemed from the concluding sentence or two of the paper that he was in doubt as to whether agriculture was taught in rural districts. There was at the present time a syllabus in the Code for teaching children in rural districts, and in every school agriculture could be taught and payment received for the teaching. It was the fault of the farmers themselves if they did not take advantage of it, and earn money in that way. There were also several text-books, some of which had been brought to him for his inspection. One was by Mr. Buckmaster, and was published by Moffat and Paige. There was a very nice series of illustrated books, and the teaching of the science was simple at the same time. He only saw one drawback in those books, and that was that at the end of the first section they entered into an analysis of manures, giving the percentage composition. He thought that in this respect the author of the book went farther than he ought to go in an elementary book. The analysis seemed to be stated in a too difficult form for the minds of children at elementary schools to grasp. Otherwise he had no objec-

tion to the book, and he thought that it was really a very good one. He did not think that Mr. Wrightson had seen it, or he would not have written as he had written in his concluding sentences. He (Mr. Clements) was decidedly of opinion that the teaching of the elements of science in connection with agriculture in rural districts must be productive of very great advantage to the children themselves. The children of those districts came daily into contact with agricultural operations. They saw a great deal of the animals and plants on the farm, and they became acquainted with many farm operations. He thought that if simple lessons were given upon such natural objects as the soil and the various kinds of plants which were grown by the farmer, and the animals on the farm, and on animal life, and practical illustrations given, such as could be easily given, the teaching would be productive of much good. He did not agree with those who said that the education of children in rural districts ought to be confined merely to reading, writing, and arithmetic. There were a great many people who held that idea, and he maintained that they were wrong. And not only in towns, but in the country also, he would educate children with a view to their after-life. He did not believe that we could give the children of the agricultural labourers too much education. He thought that we ought to give the very best possible education to every one, whether he was a landlord, or a tenant, or a labourer. If this was done, bright lads among the agricultural labourers would come forward and find their way to the front. Those that were dull and stupid of course would not. He thought that that was the object that ought to be pursued in agricultural as well as in other subjects. Mr. Wrightson said that he could wish that boys who were intended for agricultural pursuits could be trained in the elements of science. They could be so trained at the present moment, and it was the fault of the farmers if they were not.

Professor WRIGHTSON: The schoolmasters.

Mr. CLEMENTS said that remark brought him to

another point. The great difficulty in technical education at the present time was that they could only get a few men that understood the practical work and the theoretic at the same time. That was the case to a very great extent in farming at the present time. Farmers could do the practical work, but they did not understand the scientific principles underlying the practical work which they carried on. When farmers did understand that—that was when they understood both sides of the question—then they would become the teachers of agriculture; and that was what ought to take place. They ought to be the teachers. We ought not to have men who were merely schoolmasters, and who knew nothing about the practical work as teachers of science at all. That was one of the evils of the present time in agricultural teaching, and it was one of the evils in technical teaching at present. There was a great difficulty in getting a man who could perform the various operations of the different industries that were conducted in this country, and there was a great difficulty in getting men who could teach the subjects to others, and who could do the practical work themselves too. In Manchester, Liverpool, and Birmingham, they were trying to overcome that difficulty. They were trying to give children technical science instruction and also practical instruction at the same time. The two kinds were combined. The City and Guilds of London Institute were doing the very best they could in that way, and he was only sorry that that Institute could not have taken up agriculture in the same way in connection with the other subjects. But he believed that agriculture was too vast a subject. It was the greatest industry of the country, and if taken up it must be taken up by itself. He believed that the farmers and landlords of this country were greatly to blame for their sluggishness and inactivity in not starting in this work and setting about it at once. They seemed to be, Micawber-like, waiting for the Government to help them still further, but there was no good in waiting, for the landlords and farmers ought to try to do the work themselves. There was plenty

of money in the country, and there were many landlords who took a great interest in agricultural movements. The technical classes for the application of science to agricultural industry were an improvement; and why should not the landlords take it up themselves? He could not help thinking that the teaching of technical agricultural science could be made to pay. It would naturally be that in the starting of the movement there might be some preliminary expenses, but after that the expenses would not be great. He observed that Mr. Wrightson laid great stress on the subject of teachers, and rightly so. The great drawback at present was that they could not get special teachers. He only wished that the teachers in agriculture had all the same amount of practical experience, and the power of conveying that practical experience to others, as Mr. Wrightson had himself. Mr. Wrightson said that it was a matter of great regret that the sciences were not more generally taught in schools, so that students might at once enter upon them. He entirely agreed with that remark that it was a matter of great regret that sciences were not more generally taught, but he thought that we were getting upon that line, and that in a few years' time Professor Wrightson would not have to speak in that way. The paper further stated that the unanimous opinion was in favour of a combination of practical instruction upon the land with the study of agriculture. In other countries, and especially in Ireland, there were model schools for students who were sons of farmers, who had had practical experience in farming before they went to these schools. At those schools they had to do practical work during the day, and at night and in the morning they were taught by the very best teachers that could be procured. In these classes the principles of the various operations that were carried out were explained. That was really what we wanted in this country. We needed model farm-schools in different parts of the country that were subject to the influence of the different kinds of soil and climate, and we wanted sons of farmers who

had been practically trained on the farm to go to those schools and learn the technical portion of agricultural science.

Professor ARMSTRONG said he desired to take the opportunity of offering his thanks to Professor Wrightson for his very admirable paper, and of endeavouring to state the impression which the paper had produced upon him. He could not help thinking that one conclusion to be drawn from it was simply that what we required in this country was, that the public should rise *en masse* and demand that children should be educated, for it practically resolved itself into that and nothing more. Professor Wrightson had told them that the students came to his school, and to others, unprepared to begin their work at the stage at which they ought to begin it. There was not the least doubt that it was the general experience of all science teachers that the students came to the schools insufficiently prepared to do the work that they ought to do there. The consequence was that the teachers wasted their own time, and the time of the pupils, in teaching them the elements of intelligence, so to speak. What we did require at the present time was, that children of all grades of society should be better trained at school, and in such a way as to develop their intelligence. The remark which fell from the previous speaker showed that he was inclined to say that the public were to blame in this matter. Professor Wrightson had said that the schoolmaster was to blame. But he (Professor Armstrong) did not think that that was the case. He believed that if the public were once prepared to demand the instruction which had been spoken of, the schoolmaster would be bound to give it. It was not fair to blame the schoolmaster. He was now giving what he was asked to give; and they could not expect the schoolmaster to be much a-head of the requirements of the day. In the majority of cases he was a-head, and he was rapidly becoming more and more so. There was not the least doubt that before many years we should see elementary education given in the Board Schools of the kind which was

required, not special instruction in agriculture, because he believed that could never be given in a Board School. There was no necessity for it. But he believed that there would be education of such a kind as would sharpen the wits of the children. Then came the very important question as to the extent to which education was required. Professor Wrightson knew—and all in that section knew—that the amount of knowledge which we gained at college was, after all, comparatively small. Most of the useful knowledge probably was gained by subsequent study; but what we had acquired during our college career had been the power of learning. The power of learning could be acquired in many different ways. It could be acquired by the study of one subject alone. And if the suggestions which Mr. Wrightson had made could be carried out as to quoting lists of books from which the information could be obtained, he could well imagine that the student might devote himself to the study of one subject with advantage. That subject might have no connection with agriculture, and yet the student might become in course of time a good agriculturist. If he knew what works to consult he would be in a position to educate himself on the spot, so to speak. He would be in immediate proximity to the beasts and the fields, and he could study with direct reference to his requirements. He was inclined to think that that fact was a little bit disregarded. At the present time the tendency was to attempt to teach too much at the colleges. Of course the more the teaching was directed towards practical requirements the better. And there was another point which they really ought to take into consideration, more particularly with reference to the teaching of agriculture than, perhaps, to any other branch of applied science, and that was the desirability of giving instruction to the higher classes during a certain period of the year. The Scotch system, he believed, was coming into vogue in our colonies, for instance, in New Zealand. A farmer, as we knew perfectly well, had little or nothing to do during a certain period of the year, and

there was no reason why in the larger agricultural districts there should not be schools open during that period of the year, when the lads and the farmers themselves could leave their fields and go to be instructed to a very large extent in the way which had been advocated by farmers who had themselves received some good scientific training.

Professor WRIGHTSON: You said the higher classes. Do you mean the higher social classes?

Professor ARMSTRONG said that they might have all classes if they would, but more particularly the more intelligent labourers and the farmers themselves; and if they could get gentlemen like the gentlemen who came forward yesterday, the men would soon learn that science was of great importance. The fact which was at the bottom of the whole of the question which had been agitating the Conference during the week was, that education at the commencement was bad.

Mr. DRUCE said that he should like to take part in the discussion, and the chief reason for asking to be allowed to do so was, that he might thank Mr. Wrightson for his most excellent paper He might say that it was, to his mind, the very best paper on agricultural education that he had ever had put into his hands, or ever heard. It was terse, and at the same time it was comprehensive; and he really thought that any one who took the trouble to master the paper would be sufficiently well informed on every branch of the subject of agricultural education. There was only one point of the paper with which he could find fault. Mr. Wrightson described in the first instance what agriculture was, and pointed out that it included no less than ten different subjects, or sorts of knowledge. He (Mr. Druce) was willing to agree to all of them, except one. Being a lawyer himself, he failed to see what advantage there would be to a farmer, or even to an agriculturist, in having a knowledge of law. He could only say that if Professor Wrightson's ideas on that point were carried out, it would be a very happy day for the lawyers. He knew no other subject in regard to which the old saying was so

true, that "a little learning was a dangerous thing." The little knowledge of law—the knowledge of law that could be picked up in one of those books, 'Every Man his own Lawyer,' or that could be acquired by the student at college, however well that college might be conducted, and however well the student might be taught, would be to the student himself, he thought, a most dangerous thing; but to the lawyer it would be one of the very best and most advantageous. Had not that subject of law crept into Professor Wrightson's category by inadventure? When he turned to the latter part of the paper, and came to the heading "Subjects which form a complete curriculum of agricultural knowledge" (in which curriculum it was stated that the syllabus of the Royal Agricultural Society of England, of the Highland Society of Scotland, of the Institution of Surveyors, and of every agricultural college in Europe, in the United States, and in the United Kingdom, agreed) he did not find "Law." Law was omitted from that part of the paper, and the Professor's second thoughts were in this respect in the speaker's opinion to be preferred to his earlier ones. With this single exception, he personally cordially agreed with the paper. He should like, in passing, to say one word with regard to the part that referred to the labourers, and in which the learned Professor stated that it was of importance that bailiffs, dairymen, shepherds, ploughmen, and labourers should at least make an effort to give a new method a fair trial. Although he had the good fortune to be the son of a farmer, and the grandson of farmers, his own practical experience of agriculture had been very small; but even in his small experience he had seen how often it had happened that trouble was caused when a new machine was introduced on to a farm. He particularly remembered, some seven or eight years ago, when superintending the work on the farm of a deceased uncle, what terrible trouble he had, when the reaping-machines would not work, to get the labourers to understand the mechanism of them, so as to put them right and get on with the work. He thought

that some rudimentary knowledge of mechanics should be given, if possible, to labourers. Then, with regard to dairying, how often had they heard lately under what disadvantages English farmers were placed because of their want of knowledge of proper dairying. A most laudable attempt at giving instruction in dairying had been made in Ireland by Canon Bagot, whose travelling dairy was taken through the different districts of Ireland (while the state of the country permitted it) for the purpose of instructing the Irish farmers in dairying. In connection with this subject he wished to express the very great gratification with which he had heard that next week a dairy-school would be started, through the liberality of the son of that late most excellent nobleman, Lord Vernon. No man did more for dairying in his own district than Lord Vernon, and few men did more for agriculture in general than he did. When he (Mr. Druce) was an Assistant-Commissioner on the Royal Commission on Agriculture, he had the very great pleasure of staying with Lord Vernon and seeing the great good that he was doing. It was a most gratifying fact to find that the first dairy-school in which the sons and daughters of farmers and farm-labourers would be educated and instructed at a merely nominal expense, in the very latest and best principles of dairy farming, was now about to be opened by the present Lord Vernon; and that the son should, in such a noble way, carry on his late father's good deeds. It was often thrown in the teeth of English farmers that they did not accommodate themselves to circumstances, or take advantage of their opportunities, to do those things which would pay them best in their business. He (Mr. Druce), as the son and grandson of farmers, wished to repudiate that notion. He maintained that the English farmer did his best to take advantage of those opportunities which were given him; he would quote one example. It was commonly said that no farmer in East Anglia knew anything about dairy farming. When he was acting as an Assistant-Commissioner, the eastern part of England was the district which was entrusted

to him. In that district he found a tenant farmer, who farmed almost entirely arable land, or land which was by no means what was ordinarily known as a dairy farm, or a grass farm, but who nevertheless kept a large herd of cows, which he milked at 11 o'clock every night, in order that he might send the milk to a station, thirty or forty miles from London, in time to be delivered there the next morning. Did not that man take advantage of his opportunity? The farm was an ordinary arable farm, but the farmer saw his opportunity and took advantage of it, and was doing well; even in that black, disastrous year, 1879, although he did not gain money, yet he did not lose any, and succeeded in making both ends meet. Examples like this could be multiplied, and, in view of such facts, it was unfair to accuse English farmers of apathy, and of lying down and waiting upon circumstances. He wished to express the satisfaction with which he had heard in the paper of the Reverend Principal of the college at Cirencester, and also from Mr. Taylor, of the School of Agriculture at Aspatria, that there were private farms in both those districts, occupied by ordinary farmers, upon which the pupils were allowed to receive practical instruction from the farmers themselves. To his mind it was a most gratifying fact to find that this was being done both in the Cumberland and in the Cotswold Hills. He would venture respectfully to submit that some such arrangement as that should be made in other parts of England. He threw the suggestion out to noblemen, such as the Chairman, who for many years had taken a very great interest, not only in agricultural, but in general education. He threw it out also for the consideration of landlords like the Right Honourable Baronet (Sir T. D. Acland), to whom the agriculturists of this country had been so much indebted for thirty or forty years, for the name of Sir Thomas Acland was always prominent in every good work connected with agriculture. His suggestion was that landlords should permit their home farms to be used for the purpose of the practical instruction of the sons of their

tenants, and of other farmers in the neighbourhood. He thought that very much good might be done in that way. They all knew, as a fact, that the home farms of our noblemen and country gentlemen had been experimental farms for more than a century, certainly ever since the days of Arthur Young, if not before. Might he go one step farther now, and ask the present large landowners of the country to extend the operation of those experimental farms, by allowing the sons of their tenants, and of the neighbouring farmers, an opportunity of seeing the agricultural experiments which were conducted on them, and the methods of agriculture which were there carried out.

Mr. J. K. FOWLER (Aylesbury) said that as a tenant farmer, and, he hoped, a practical one, he wished to make a few remarks on the general question of agriculture and agricultural education. A great deal had been said of the labourer and of his want of education, and also on the lack on the part of the tenant farmer; but he thought on the whole that both those classes had shown, in almost every relation of life in which they were thrown, that they were not deficient in the mental characteristics and in the mental power which might be brought into almost every subject relating to the science and the industry with which they were connected. He had repeatedly found that our agricultural labourers, who were much sneered at by those who did not understand them, were a most intelligent class. He would ask any one who knew practical country life whether the agricultural labourer did not find his employment as a young man in the great work of scientific agriculture, and whether the labourers who went with the farm engines were not very capable men, and indeed the most able men that were to be found in Mr. James Howard's, Clayton and Shuttleworth's, and other factories. Nearly all those men were agricultural labourers, selected because they had shown some adaptability with regard to mechanics and otherwise. He regretted to say that very often formerly they could not read and write, but that state of things had passed away. With regard to the agriculturist himself, he had lately

attended some lectures of Mr. Buckmaster in a very rough agricultural district, and he was greatly surprised to see how labourers and small farmers came forward to see whether they could get any information from the lectures that were being given. He would say nothing one way or the other as to the results of the lectures; but he could say that the men came forward and availed themselves of the opportunity. There was another point with regard to education of farm labourers. He hoped that it would not be understood that he was saying one word against education, for he was greatly in favour of it in every department, but the tendency of the present system was to make agricultural labourers better scholars, so that they rushed out from the line which farmers desired that they should pursue, as tillers of the soil, and went into the town and got situations as porters at railway stations, policemen, and porters in various establishments, and many of them became clerks in lawyers' and other offices. They thought it a great thing to become a clerk and put on a black coat. They were, however, beginning to find out that those industries were rapidly becoming overstocked, and the general tendency was to lower the rate of wages of that class of people. There was no advance of wages whatever in town districts with regard to clerkships and similar occupations. There was a very great tendency to reduce the price of their labour, while, at the same time, the fact that these young men were withdrawn from agricultural pursuits had had a very detrimental effect upon the farmer in the cultivation of his land, and the raising of the price of labour. He believed that ultimately the labourer would find his level. He was beginning to find it in the rather benighted district in which he was living amongst the Chiltern Hills. There was another point to be considered with regard to farmers' sons. Farmers lived in isolated districts. The place in which he was now residing, although within thirty miles of London, was ten miles from a railway station, and ten miles from the county town, and the difficulty of getting together young men, who lived three or four miles apart, after the

labours of the day on a winter's eve, which it was thought was the best time for technical instruction, was very great. Professor Wrightson's paper contained various suggestions as to the points which needed illustration. But he was inclined to think that there was rather too much put down as the curriculum of agricultural instruction. The rudiments of chemistry, geology, and perhaps botany, were most useful and very valuable. Mensuration was also a most excellent subject, and book-keeping was especially useful. With regard to book-keeping, he was very much struck with what Mr. Magniac said in the House of Commons in a discussion that took place on Mr. Clare Sewell Read's question with regard to the income-tax being levied upon certain portions of agriculture. Mr. Magniac stated that the farmers did not keep accounts, and that he had employed some of the best to assist him, and that he had gone through his accounts most carefully, but he was bewildered in attempting to make an annual account of the profits and losses of his farm. He (Mr. Fowler) was perfectly certain that it took five, or six, or seven years' rotation before a man could actually ascertain the value of the profits of his farm. He observed that drawing was put down among the subjects to be taught. That subject was a most important one, though it was little thought of. How often was it that a farmer required some alteration in his machinery, or in his house or premises, and was utterly incompetent to take his pencil and give an idea upon paper of what he really wished. Elementary drawing was of extreme value. The study of drawing would improve a man's perception of form, and that was a very important matter in dealing with the breeding of animals. Another subject which was mentioned was forestry. That also was most important in various districts. Mr. Wrightson suggested that agriculture might be made part of the curriculum in Board Schools; but technical education really began on the farm with such operations as couch-burning, and the labourer went on until he was considered to be at the top of the tree, and

able to manage a farm. These were matters which must not be lost sight of in the educational course; but he wished to know how, with all this education, they could teach a farmer to grow wheat at 4*s.* 6*d.* a bushel, and barley at 4*s.* a bushel, and oats at half-a-crown a bushel, and hay at £3 a ton.

Professor WRIGHTSON: And sell rams at eighty guineas.

Mr. FOWLER: Exactly, and I am happy to say that I have sold shorthorn calves at 200 guineas. There is no doubt that, with all this education which we are receiving, and all the education which we are giving to our labourers, and that with all the education that even our landlords and gentry have at the present day, the practical point to which we must come is how is the land to be cultivated at a profit, and how are we to go on under the present system.

Sir THOMAS ACLAND said that Professor Wrightson, who had read the paper, was carrying on a most important work, and he had been appointed by the Government to one of the most important situations connected with agriculture. He was not only a professor of agriculture in the Science and Art Department, but he was also an examiner. Up to the present time they had had but one examiner, a Devonshire man, but now Mr. Wrightson was associated with him. He (Sir Thomas) had a very great respect for Professor Wrightson in his official capacity, but he must say that having read his paper very carefully, and being ready to assent to Mr. Druce's statement that it was a very able paper, he must say that it appeared to him an impossible paper. He would remind them of what passed at the Chester meeting of the Royal Agricultural Society when Mr. Gladstone made a memorable speech; in that speech Mr. Gladstone told them that agriculture had begun with the creation and would go on till the crack of doom. Then he enumerated all the sciences which were necessary to make an ideal and perfect agriculturist. The list was about the same as that contained in Professor Wrightson's prospectus of what he was going to teach to those persons

who, as we are told, were not sufficiently educated to take in scientific ideas. Mr. Gladstone went through the list and said, "Now here is a mass of difficult and profound scientific knowledge. The intellect of the greatest man that ever was born could not possibly contain all these sciences." It was absolutely impossible for any one man to know all these. If Mr. Wrightson could put all the knowledge into the heads of the Devonshire farmers or their sons, he (Sir Thomas) would be very much obliged to him. He confessed that he should like to see a different sort of prospectus. One of the difficulties of the course which was proposed was the expense which it would entail. He found that the fees at Downton College were £129 a year. How were those gentlemen who sold wheat at 4*s*. a bushel to afford £129 a year to give their sons this course at the age of eighteen?

Professor WRIGHTSON: Would the honourable gentleman tell us what he would like put out of the prospectus?

Sir THOMAS ACLAND said that he would when he was made a professor. He would like to know what could be put into the heads of the pupils. There were certain sciences which were part of a general mental training suitable for any man who went into any business, so far as they educated a man's mind and led him to know his own ignorance, and how very much there was to be learned which he could not possibly learn before he was one-and-twenty. He should be delighted that they should be taught, but when the curriculum included fifteen subjects, it seemed to him that it would not work well. He thought he could illustrate his meaning by the very able speech of Mr. Druce, who inherited from two generations of farmers a good deal of practical knowledge, and was himself a man of high education, and who had also had the advantage of travelling round the country and seeing practical farmers struggling with their difficulties, and had reported to the Government on the subject. Mr. Druce had unconsciously given them a considerable step towards the solution of the question. Mr. Druce had called attention to the fact that

Mr. Wrightson was going to teach law. He did not suppose that Mr. Wrightson thought he was going to teach people to give opinions on conveyancing questions, or to go into courts of justice as advocates, or to sit on the bench as judges. But he supposed that he was going to teach them some very few elementary principles. He quite agreed with Mr. Fowler that these men had got brains and that they used them in Local Government. He maintained that what was true of law was true of all the other subjects. Agriculturists must know enough of the subject of law to be able to put their questions intelligently to a lawyer and to get an answer from him ; and the same thing was true of all the other general subjects. Let the farmers just know enough of a science to know that they did not know the science, so that they could put their questions intelligently to those scientific men who could answer them. In the year 1847 he was set to work by Mr. Pusey to collect information on agriculture, and this work did him a great deal of good. For eighteen years he passed his life amongst farmers, trying to help them to work out those questions with which they had to deal. He went to King's College laboratory and worked there for four or five months, and though he did not become a chemist, he learnt enough of the language of chemistry to be able to ask questions of Professor Voelcker. He had been asking questions these thirty years, and the more questions he asked and the more good answers he got, the more he saw the enormous practical difficulty of the question they were discussing. He had absolute belief in science, but there were so many unsolved questions, and the application of what is known was so difficult, that no man could become master of all the sciences so as to use them in a practical way. He thought that they ought to be careful what they were about. In part the public were to blame for their expectations on the subject. Parents were to blame for fancying that by a little smattering of these sciences their sons could learn a great deal. But also some examining bodies were to blame. The science teaching was not put on the best

possible footing for testing the work of the colleges. The colleges were obliged to work partly up to the parents and partly up to the examiners.

Mr. F. J. LLOYD said that in Mr. Wrightson's paper there were thirteen sciences and five other subjects enumerated as those which the student of agriculture had to learn. He thought that the fault of the higher education in agriculture was an attempt to do too much. He believed that criticism applied both to Mr. M'Clellan's paper of yesterday and to the paper which had been read by Mr. Wrightson to-day. The consequence of attempting to do too much was that nothing was done thoroughly. A little education which was thorough, and which a man would carry with him through life, was infinitely better than a smattering of eighteen sciences, none of which would prove of any use subsequently. He regretted that Professor Voelcker was not present. As examiner of the best men who came up from the colleges to the Royal Agricultural Society to be examined, Professor Voelcker had, he believed, found that they were completely muddled, and could not understand simple things which they ought to know thoroughly. If they had elaborate questions, they might be able to answer them in some way; but if they were questioned on simple practical things which they met on the farm, they were "nowhere." The questions set in the examinations at the colleges were too high, and went into the theories of the sciences, as if the professors wanted to make each man a scientist. He had seen questions on the highest theoretical propositions of chemistry. Of what use was that knowledge to a farmer's son. All that the farmer wanted to know was how to comprehend and appreciate the information which was given to him by scientific men. What the farmer really required was to understand the language which the scientific man was bound to use. They were speaking now to men who had not had the opportunity in their youth of learning the elements of science, or even the words in which science was taught. The farmers of the present day were out of all sympathy

with science, because as youths they had had no instruction in science, hence scientific men spoke to farmers in a language which they did not understand, and men were never in sympathy with those who spoke a tongue foreign to themselves. A boy who went to a school and attempted to learn agriculture, found his father and those whom he met had no sympathy with the science of the subject. That was a drawback, and it must be overcome. It was the great reason why every effort should be made, by lectures in the country or by small thoroughly-good works, to bring the agricultural classes of every grade into harmony with science, and out of their present antagonism to it. With reference to the Science and Art Department and the examinations in agriculture, he presumed that the examination was originally intended to awaken the agricultural classes to the value of the science underlying agriculture. But he believed that this effort had partially failed, because the education given under the Department was not of practical benefit, and a practical farmer would scoff at it. Professor Wrightson said that teachers were depending entirely on text-books. A teacher who limited his agriculture to a text-book would be non-plussed by an intelligent agricultural boy, who would have more knowledge of the real things than the teacher himself. If the Science and Art Department was to do any good whatever, it must be in the direction of so arranging the examinations that they could not be passed by mere text-book work. One method which he would recommend was that outline drawings—say of animals—should be given on an examination-paper, and that the pupils should be asked to point out any faults that existed in the animals which were represented. He did not think that any text-book cramming would enable a boy to answer such a question as that. He believed that this method was used in Germany, and it might be adopted here with success. He would suggest that the Science and Art Department might advantageously add to their large and instructive museums a branch purely agricultural, where the produce of the

fields, models of the internal structure of farm animals, representations of the diseases of animals and plants, &c., &c., might be exhibited.

Mr. ROWLANDSON said that he had farmed in a neighbourhood in close proximity to a large town where there were large iron industries and other works, and he had had to contend, especially during the years from 1872 to 1876, with a very great demand on the part of those works for the very best of the agricultural labourers. In the year 1862 he was one of four farmers who first introduced steam machinery into his neighbourhood. A company was formed, of which he was appointed secretary, and he endeavoured to obtain the best agricultural labourers he could find and intelligent men; but the best men he could get were attracted away by the higher wages which the agricultural implement makers were able to pay to men of that description. He had had numerous applications for steady clever agricultural labourers, who were wanted in positions of trust. There was one point which seemed to have been somewhat forgotten in Mr. Wrightson's paper, and he was afraid that it was also somewhat forgotten in many of these discussions on agricultural subjects, and that was that we must keep in view what a man had to be a farmer for. In the majority of instances, a farmer had to make his way in the world and to live. In these days he ought to know thoroughly the value of various kinds of stock and other agricultural produce which he had to sell; and although the theory and practice of science might, to a certain extent, enable him to carry on his farming by somewhat better principles than he could otherwise, yet a knowledge of weights and values ought to be ingrained into a farmer when he was a youth. Unless we could first of all ingrain into young agriculturists a thoroughly practical knowledge of the work of a farm before they were taught the scientific principles and theories connected with the subject, he was afraid the science-teaching would be of very little use.

Sir BERNARD SAMUELSON, M.P., said that he thought

that the value of the Report of Mr. Jenkins to the Royal Commission, over which he (Sir Bernard) had had the honour to preside, could not be overrated. Some of its recommendations appeared to be visionary at the present moment, but he believed that the time would come when they would look upon that Report as a starting-point in agricultural education in this country. Of course different persons would have different views about detailed portions of the recommendations which had been made by Mr. Jenkins, but taken as a whole these recommendations could scarcely be differed from by those who had the prosperity of agriculture at heart. He would single out two of those recommendations as the most important. The first was that our great agricultural societies should devote themselves more especially than they had hitherto done to the encouragement of agricultural education, although he was quite willing to acknowledge that they had done much. As times progressed, so the functions of those great societies changed. They could not be the only things in this world which were to be unchangeable, either in their objects or in the means by which those objects were to be pursued. There was a time when the improvement of agricultural implements could be stimulated by prizes. The great societies had discovered that that time had nearly gone by. Consumers might be trusted to know what would best suit their wants. What had occurred with regard to agricultural machinery was, he believed, on the point of occurring, if it had not already occurred, to animals. Immense sums were devoted yearly to prizes for animals. He was not quite sure that the encouragement offered by those prizes always tended in the best direction; but whether that was so or not, he would say the same thing with regard to prizes for animals as had become generally acknowledged already with regard to prizes for machinery. Breeders of animals knew what would suit them best, and if an animal was produced that would suit a breeder, he would pay the price for it. If prizes for these objects were abolished or diminished, the change would set at liberty a

would go where they could find them. But agriculturists could do one thing. If they could not keep the best labourers, they could raise the status and the intelligence of the second best, and he thought that if they did that they would have done a work which would be advantageous to the country at large. Mr. Rowlandson had said that we must bear in mind that agriculturists had to live. The agricultural machine-maker and the ironmaster also had to live, and he was sorry to say from personal experience that the ironmaster, at any rate, had considerable difficulty at present in making a living. What applied to the farmer applied equally to all trades and all technical pursuits, for farming, after all, was neither more nor less than a technical pursuit. They required practice with science, and all the science in the world was of no use unless they had practice. The question was, which was to be acquired first, or whether they were both to be acquired together. He believed that in the majority of cases it would be possible to acquire both at the same time. They found, with regard to mechanical occupations, that evening classes were doing an immense work throughout the country. Young men of intelligence and energy (for all depended upon energy) were employed during the day-time in the pursuit by which they were to gain their livelihood, but they attended classes in the evening in those sciences which were the foundation of the pursuit in which they were engaged; and he saw no reason why by some half-time system, or more properly evening classes, the same thing might not be done in connection with farming. Distances which were formerly obstacles were no longer so. We had railways in every direction throughout the country, and there was no reason whatever why young men from certain areas should not attend classes in those subjects which had a direct bearing upon their profession in the market towns.

The Rev. Prebendary BRERETON, referring to the remark of the last speaker with regard to the Royal Agricultural Society and other societies turning their attention to the

large amount of funds which might be devoted—and which he believed might be devoted with very great utility—to the encouragement of agricultural education. He did not feel himself competent to give an opinion as to the details of the way in which this might be best done, but he was firmly convinced that a greater amount of attention and a larger amount of funds might be now, with advantage, devoted to agricultural education by our great agricultural societies, and that those funds might be in part derived from the funds which were now allocated to the giving of prizes for animals. The second of the two recommendations to which he had alluded related to the question of agricultural education in elementary schools. Here, again, he was not prepared to enter into detail, but he thought that in the teaching of children who were to be employed in agriculture, a sufficient latitude should be afforded by the Code to enable the subjects which would be of importance to them in after-life to be taught to them instead of subjects which might be of great importance to mechanics and tradesmen, but less useful to agriculturists. He quite agreed with what Mr. Wrightson had said about the examinations of the Science and Art Department being made as practical as possible. Every one knew that there was a great difficulty about it. Examinations and text-books were almost correlative terms; but the difficulty must be overcome in some way, because if it was not overcome the result would simply be that the imperial funds would be applied to the augmentation of the stipends of elementary schoolmasters in a way which was never contemplated. These were the two principal points of Mr. Jenkins's Report, which he would strongly commend to the attention of all those gentlemen who were able to promote agricultural education. With regard to the remarks of Mr. Rowlandson, he would observe that agriculturists were not the only persons whose labourers were tempted away by superior remuneration. The same thing applied to mechanical and commercial employments. The best labourers would always look for the best wages, and they

would go where they could find them. But agriculturists could do one thing. If they could not keep the best labourers, they could raise the status and the intelligence of the second best, and he thought that if they did that they would have done a work which would be advantageous to the country at large. Mr. Rowlandson had said that we must bear in mind that agriculturists had to live. The agricultural machine-maker and the ironmaster also had to live, and he was sorry to say from personal experience that the ironmaster, at any rate, had considerable difficulty at present in making a living. What applied to the farmer applied equally to all trades and all technical pursuits, for farming, after all, was neither more nor less than a technical pursuit. They required practice with science, and all the science in the world was of no use unless they had practice. The question was, which was to be acquired first, or whether they were both to be acquired together. He believed that in the majority of cases it would be possible to acquire both at the same time. They found, with regard to mechanical occupations, that evening classes were doing an immense work throughout the country. Young men of intelligence and energy (for all depended upon energy) were employed during the day-time in the pursuit by which they were to gain their livelihood, but they attended classes in the evening in those sciences which were the foundation of the pursuit in which they were engaged; and he saw no reason why by some half-time system, or more properly evening classes, the same thing might not be done in connection with farming. Distances which were formerly obstacles were no longer so. We had railways in every direction throughout the country, and there was no reason whatever why young men from certain areas should not attend classes in those subjects which had a direct bearing upon their profession in the market towns.

The Rev. Prebendary BRERETON, referring to the remark of the last speaker with regard to the Royal Agricultural Society and other societies turning their attention to the

encouragement of agricultural education, said that not more than three years ago His Royal Highness the Prince of Wales, who was known to take the greatest possible interest in agriculture, addressed to him (Prebendary Brereton), as the Chairman of the Norfolk County School Association, a letter especially calling attention to the importance of considering how far agricultural education might be connected with the county schools. The association held a meeting, and of course very carefully considered His Royal Highness's communication, and he was bound to say that they were all agreed that the county schools should not profess to educate future farmers so much as to provide the best education for farmers' sons, as a very large branch of the community. They did very much wish to consider how, having secured that first object of an economical good general education, they might contribute to the solution of the other problems which were put before them. He believed that they were anxious to deal with those problems practically, provided only that it should not interfere in any way with the first object of public education as tested by public standards. It seemed to him that the establishment of large schools like county schools, would enable them to draw together a variety of teachers who could at an early stage turn the attention of boys to the special branches of knowledge. In connection with county schools, in order to give them a standing, an effort had been made to establish Cavendish College at Cambridge, and it was hoped that there, in due time, they might offer facilities for obtaining knowledge from the very best scientific teachers in those branches which would affect agriculture. He therefore hoped that the Royal Agricultural Society would move in the direction which had been suggested. He was sure, from the opportunities which he had had of meeting the leading agriculturists in England, there was a strong desire that the thing should be done, only that no false step should be taken.

MR. ST. JOHN ACKERS said that many of Professor Wrightson's remarks were excellent, but, as Sir Thomas

Acland had pointed out, they would be difficult to carry out, and he did not see that Professor Wrightson had himself attempted any solution of the way in which his suggestions were to be put in practice. He knew from personal experience that there was a great deal too much teaching in the Agricultural Colleges, and a great deal too little practice. He knew one gentleman who went to an Agricultural College without knowing anything whatever of science, and who was so sufficiently and ably taught the science of chemistry that, instead of becoming a farmer, he took up the much more lucrative profession of manufacturing chemist. He would like to make one or two remarks upon what had fallen from Sir Bernard Samuelson, whose presence there that day they must consider to be most opportune. They had heard from him that prizes used to be given for machinery, and that it had been found hardly necessary to continue that practice, because, as he (Mr. Ackers) took it, the granting of those prizes had so stimulated invention that very nearly the best possible results had been obtained; but Sir Bernard Samuelson made some remarks with regard to giving prizes for cattle, and he seemed to indicate that, in his opinion, the prizes which had been given were not given in the best possible direction, or did not always attain the best object. If that was so, he (Mr. Ackers) would ask whether the wisdom which enabled the Agricultural Societies so excellently to arrange with regard to machinery might not be really doing the same thing in the direction of cattle. But the point to which he was most anxious to come was one which he thought was of the utmost importance to agriculturists and farmers throughout the country. They all knew what building it was in which they were then assembled. They knew that they were in one of the most important buildings probably in this country. It represented a new departure in technical education. They were immensely indebted to Mr. Magnus, his colleague in this section, and to others of the City Guilds, for that magnificent building, and for the good which it would doubtless bring forth in technical

education, and improvements in science as applied to the manufactures of the country. Mr. Magnus was a most eminent member of the Royal Commission on Technical Education, of which Sir Bernard Samuelson was the head, in which capacity he had received a most well-deserved honour, which they must all be delighted to see bestowed upon him; but that was a Royal Commission appointed to consider technical education in this country with reference to other countries, and to see how best it could be carried out here; and yet the most important of all branches—agriculture—did not find in that Royal Commission persons able to undertake the examination of such a great question themselves. What did they do? They did the next best thing possible. They asked the most eminent man probably that we have in this country to report upon the subject. This report, as Sir Bernard Samuelson had said, would be the report which he had no doubt would mark the commencement of a new era in agricultural education. But the point which he wished to press was this—that evidently the ruling authorities who appointed that Commission, did not consider agriculture to be sufficiently important for them to place upon that Commission those who were trusted agriculturists, and able, both in the opinion of agriculturists at large and themselves, to conduct an agricultural inquiry.

Sir BERNARD SAMUELSON: I think that the commission was appointed to enquire into the agricultural distress; and if the want of technical education had any bearing upon that, one would think that it should have been studied by that Commission.

Mr. ACKERS said that the fact that Mr. Jenkins was appointed was worth all the arguments that could possibly be brought forward. Sir Bernard Samuelson had spoken on distances being in these days comparatively nothing, and he had said that farmers' sons and others might attend evening classes. This showed how little he appreciated the circumstances which existed in the country. He (Mr. Ackers) should like to see a railway on the top of the

Cotswold Hills, taking people down from this, that, and the other place to the evening classes. We must get rid of a great many theories. Although agriculturists were glad to find gentlemen of high position coming forward, yet, as practical farmers and practical agriculturists, they must consider that the more they met together in friendly converse, the more likely were they to be able to make known something of the practical side of the question. Agriculturists were ready, as far as their opportunities allowed, to welcome, with the right hand of fellowship, that science which bore upon agriculture.

The CHAIRMAN (Earl Fortescue), in closing the discussion, said that he would not go at any length into the Professor's paper, but he agreed with the criticism that the schedule of arts and sciences, some knowledge of which was described as essential to the practice of agriculture, was too extensive and formidable; and he agreed with Sir Thomas Acland and Mr. Lloyd that one of the great points to be aimed at was, that farmers should just understand their own ignorance, and the value of those sciences to practical agriculture; and that, as they knew, when they were ill they ought to go to a doctor, so, instead of attempting to conduct analyses themselves, they should master the language of science sufficiently to understand and appreciate the analyses made by others. Not in law only was a little knowledge a dangerous thing. A little knowledge was good if it was accompanied with modesty. A little knowledge was dangerous if it promoted conceit. And one of the most valuable parts of knowledge was to know what one did not know, and how to apply to others who did know, and how to turn their advice to account. Mr. Clements expressed surprise that landlords had not done more for agricultural education. All he (the Chairman) could say was, that his hair was of a very different colour indeed when he became a shareholder in the Cirencester College, and from that day to this he had not seen a farthing of return from that undertaking, his only reward being the satisfaction of promoting science in agriculture.

Sir THOMAS ACLAND said that the noble Lord Fortescue was too modest. Lord Fortescue and his father started one of the grandest and most expensive experiments in North Devon that was ever made.

The CHAIRMAN said that the experiment referred to by Sir Thomas Acland might have been instructive, but a portion of it was a most useful, though perhaps not a very cheap, warning. On the whole, however, perhaps it was not to be regretted. Mr. Clements had given them a general statement as to the advantages of knowledge to everybody. Knowledge was most valuable to everybody. He wished that every labourer, as well as every employer, knew a great deal more than he did; but Mr. Fowler had referred to something which was more essential, and that was the question of how people were to live. The half-time system was not always practicable. It was not always found easy to manage it in agriculture, on account of the change of clothes which was necessary. The boys might come in dirty from work in deep mud, and so on, and such facts would form a practical difficulty in the way of what Mr. Chadwick had demonstrated to be most advantageous otherwise—the half-time system which afforded work for the mind and work for the body. He (the Chairman) might be allowed to say, with regard to such generalisations as to the utility of knowledge to all classes, he desired that the workmen should learn a great deal; but the longer that people were kept at learning, the longer they would be debarred from earning, and earning not only for their own profit, but also for the profit of those who employed them. One of the great difficulties at that moment in England of keeping farms clean, was the difficulty of getting weeding done. The children were kept to the fourth standard, and enthusiasts were looking earnestly to everybody passing the fifth standard. The result was that weeding which could only be done by cheap labour, if done at all now, was most painfully and disadvantageously performed by those whose labour was cheapened by advancing years, with stiffness, and other infirmities. In

many districts the farmers were unable to get children to keep the farms clean. His own view was to have a limited number of scholarships for the brightest boys, to carry those boys on to higher education who were worthy of some sacrifice of earning, in order that they might be carried on in learning. He had for a long time taken an interest in the Devon County School, the first county school which was established in England. When he last enquired, he found that that school had passed a greater number of boys in the University Local Examinations, with certificates of competence, than any other school. The real test of the goodness of a school, it ought to be borne in mind, was its average produce—not the prize gooseberries, but the general crop. He had long been of opinion that injury, instead of benefit, was done by the great agricultural societies in giving prizes for breeding animals in which over-fattening was encouraged to a degree that incapacitated or deteriorated them for breeding. And he desired most earnestly that the societies should devote a great part of their funds to the encouragement of education. He believed that the best way in which they could do that was by establishing scholarships for enabling lads to bear the expense of going to finish their agricultural education where they could get higher and more scientific teaching. The work of schools would always be very much determined by the examinations to which they were subjected; and the work of the Devon County School had been very much determined by the University Local Examination, which they owed, he must add, to his old friend Sir Thomas Acland; but those university examinations, to a great extent, guided and determined the course of study in the schools. He hoped the Universities themselves would find themselves able to give facilities for studying practical agriculture to a certain degree, on the same principle as that on which Professor Stewart had so successfully established workshops in connection with the high intellectual and mathematical teaching given in Cambridge. The noble

Chairman concluded by moving a vote of thanks to Professor Wrightson for his paper.

Professor WRIGHTSON, in reply, said that he would remind one of the speakers that he particularly asked the Conference to sink the great issue as to the utility of certain sciences to a practical industrial art like agriculture. He had asked them to do so, because the issue was a very large one, and one upon which men had made up their minds; and it would probably be impossible at that time to change their minds. He wished rather to accept the judgment of the entire civilised world in Europe and in America with reference to the usefulness of science to all arts, whether agricultural or otherwise. He considered that in the year 1884 it would scarcely become him to dispute the practical usefulness of the sciences to agriculture, or to any other industry or art. He was prepared to defend their usefulness, but he considered that it would be a waste of time to do so. It was a question which was bound to be answered in the affirmative. The greater progress that was made the more would it be found that a scientific education was necessary, in order to the thorough understanding of practical detail. He would leave the point with the distinct feeling that if the point he had stated was not altogether clear to the minds of some persons, the reason was that they had not gone sufficiently into the question; and time would justify those who considered that the teaching of any art must be accompanied with the teaching of all those sciences which bore upon it. He considered that that was a conclusion which rested upon the very firmest foundation, and if there were gentlemen in the room who differed from him, and who thought that there was a certain degree of unsoundness in the idea that *ologies* bore upon the practical carrying out of industrial arts, he was quite prepared to leave the matter to the verdict of time. Perhaps it might be thought that after all that was not the point at issue. He had been accused of over-burdening the syllabus of subjects, and having introduced too long a list of studies. Here

again he was convinced that in introducing the names of certain sciences that there was not one subject which was mentioned in his paper which they could afford to omit from any complete curriculum of agricultural education. He would challenge any gentleman, even Mr. Druce, to mention a single subject which could be omitted; and although he might be inclined to consider that the subject of law might be omitted with greater fitness than some other subjects, yet he maintained that in any college where there were to be trained not only farmers but landlords and land agents, it was obsolutely necessary that they should have a knowledge of law. Sir Thomas Dyke Acland held it to be necessary that they should have some knowledge of chemistry before they could go and take the opinion of Dr. Voelcker. He (Mr. Wrightson) had sometimes found it a disadvantage, when he had gone into a shop to make a purchase, not to know precisely what he wanted. For instance: he might be asked with regard to a particular thing, "Do you want it mild or strong? Do you want it sweet, or do you want it dry?" It would be very puzzling to know how to answer if he did not happen to know the meaning of the terms "sweet" and "dry" in the connection in which they were used, and he would perhaps reply, "Well, I want it good. Will you kindly advise me as to what I really want?" This weakness could only be remedied by studying the subject and getting a knowledge of it. The knowledge which Sir T. Acland obtained by a four months' study at King's College laboratory was a very fair guide as to the direct usefulness of the scientific knowledge which would be obtained at an agricultural college. A knowledge of the subject of law was no doubt required by land agents. They had to talk about the enfranchisement of the copyholds, and they had to discharge parochial duties, and duties connected with the Local Government Board; and he held it to be of the very utmost use that they should have a knowledge of law; not that kind of knowledge which would enable them to act without a solicitor; but that which would enable

them to have their minds open, as it were, to the subjects which concerned landholders and land agents in exchanging property, and for various other purposes, it was necessary that a certain knowledge of law should be obtained in any school which pretended to fit or prepare students for the career of a land agent. He believed that if Mr. Rogers of the Institution of Surveyors was present, he would certainly bear him out in saying that a certain amount of legal knowledge and a prepared condition of mind with reference to legal matters was not at all superfluous, and that it was a perversion to come before a meeting of that kind and to advise gentlemen that a little knowledge of law was a dangerous thing, or to give them an idea that that little knowledge would be better dispensed with altogether. He did not think for a moment that if they were disposed to do without legal knowledge in the curriculum of instruction they would be disposed to apply the same rule to the other sciences which were mentioned in his list. It was impossible that they could consult with reference to an analysis of manures, if they did not know what an analysis was, and if they had no idea of what the fertilising materials were. If they were thus ignorant, they would be in an entirely false position in consulting an agricultural chemist. He (Professor Wrightson) could not help the nature of things. He could not help it that geology was a part of agriculture. It was not his doing that it was so. Geology was the knowledge of the earth, or the knowledge of soil—Did any one mean to tell him that a knowledge of the soil was not essential to the tiller of the soil? Let them take any one subject they chose: there was not one which they could afford to strike out without throwing themselves open to the charge of having made an imperfect scheme. He could imagine that there were other subjects which ought to be inserted in the curriculum before they could say that they had constructed a perfect syllabus, but he could not imagine one of the subjects which he had enumerated being struck out without his being charged with having brought before the public an imperfect syllabus. Let them say which of

the subjects could be struck out, and he would sit down without saying another word, and hide his diminished head, and consider that the subject of agricultural education had been improperly handled. The names of the subjects were high-sounding, but it did not follow by any means that the student was to be over-burdened. With reference to the mention of botany, a person might say, "Oh, you are going to tell the student all about cell-formation, and all about the functions of the various parts of plants." He would reply, Perhaps so; but agricultural botany is a knowledge of the cultivated grasses and of the weeds. The man who was intimately acquainted with that department of botany might take a high rank among botanists, just as a gentleman in Germany had achieved a reputation among botanists by studying the willow; and the man who understood wheat and the fructification of wheat, and the botany of the plants cultivated on a farm, and who was able to throw light as the late Charles Darwin threw light on the domesticated animals of the farm, would be a biologist of no mean stature. In teaching the biology of a farm they were not pledged to all the intricacies of the science, and they would justify the name of biology completely if they confined themselves to the animals and the plants with which they had to do. It was quite possible to handle the subjects which had those high-sounding names in such a way as to make them thoroughly agricultural. But when it became necessary for persons who were at the head of an agricultural establishment to construct a syllabus or curriculum, it behoved them to make that curriculum as perfect as possible. It did not follow that every student was to pass through the whole curriculum. A choice of subjects ought always to be allowed, so that young men who had not a talent for sciences might be able to choose, just as in large schools boys were passed on to the modern side on account either of their want of ability, or of their having a reason for wishing to receive practical instruction.

The Rev. Prebendary BRERETON said that he felt that

all that Mr. Wrightson was saying would be true if they were to establish an agricultural university, but he did not know how an agricultural university would differ from one of the present universities.

Professor WRIGHTSON said that he might be allowed to bring his remarks to a conclusion by saying that every subject should be mentioned in a curriculum, but that the subjects might be specialised so as to bear upon the task of the agriculturist, and, that although every subject was mentioned, it did not follow at all that every student was required to pass through the whole.

The section then adjourned for a short time.

At two o'clock the proceedings were continued, Earl FORTESCUE again occupying the chair.

SCHOOL-FARMS AND FARM-SCHOOLS.

By H. M. JENKINS, F.G.S.,

Secretary of the Royal Agricultural Society of England, and Editor of the 'Journal' of the Society.

WHEN Shakespeare made Puck say

> "I'll put a girdle round about the earth
> In forty minutes,"

he doubtless thought this assertion the embodiment of impossibilities to mortals. But nowadays such an achievement is easy in comparison with what I have undertaken, which is to put before you, in not more than half that time, a scheme for what, as the phrase goes, is "Upper Middle and Lower Middle" Agricultural Education.

If, therefore, I do not discuss all the difficulties connected with the subject, I must ask you to grant that it is not because I have overlooked them, but because time is want-

ing to enable me to present them to you on this occasion. That part of the subject I desire, in fact, to relegate to those who may take part in the discussion which, I hope, will follow the reading of this paper. By this mode of procedure all of us who are interested in agricultural education may obtain the advantage of the impressions and opinions of others placed before them, many of whom may regard the subject from a different point of view than myself.

First of all, before stating my own views, I wish to explain the title of this paper. By "School-farms" and "Farm-schools" I do not intend to imply an unmeaning somersault of words; but I wish to indicate a very important difference in the nature of the two kinds of institution. In the "School-farm" the "farm" is subordinate to the "school," whereas in the "Farm-school" the "school" is subordinate to the "farm."

Neither of these institutions can be said to exist in England at the present time, unless we make exceptions in favour of the "Aspatria Agricultural School" in Cumberland, and the "King Edward School" in Aberdeenshire, both of which, as now constituted, approach my ideal of "School-farms." Therefore, you must clearly understand that, as regards our own country, what I am about to describe is a project—some may call it a dream,—but, as a system, it certainly is not yet a reality.

The "School-farm" that I wish to see established has its equivalent to a certain extent in Germany, in the *Landwirthschaftsschulen*, sixteen of which flourish in Prussia; but still more closely in France, where there are about ten such establishments, known as *Écoles pratique d'Agriculture*, and their number is increasing every year.

The "Farm-school" is similarly represented in Germany by a large number of *Ackerbau-Schulen*, and in France by a score or more of *Fermes-écoles*.

Commencing my brief survey of these institutions with the "School-farm," and its foreign equivalents, I may say that their function is to provide a combination of general and technical education for the sons of tenant-farmers and

small proprietors. In both France and Germany the State contributes to the maintenance of these institutions, but in Germany the grant in aid is divided between the Imperial and the Provincial Governments. Another difference is that in Germany these schools are what we term "Day-schools," whereas in France they are what we call "Boarding-schools." Any comparison of the cost of education at these institutions is therefore impossible, nor can a fair allotment be made between its cost to the parents, the State, and the Province.

A statement of the actual facts, however, may be of some interest. The sixteen school-farms in Prussia are attended by 1650 pupils, or an average of more than 100 each. The school-fee amounts to about £5 per head per annum, and the subsidies to the school from the State and the locality combined are nearly twice as much more, making the total cost of education alone at these schools about £15 per head per annum. These German schools subordinate the farm to the school in a greater degree than is, in my opinion, desirable; but still a certain amount of land, greater in some cases than in others, is attached to each for purposes of demonstration. The curriculum is fixed by the Government, and the only variation allowed is with regard to what two foreign languages are taught. Even in this matter the parents have no choice. The director of the school is the sole judge, subject to the approval of the Minister of Education. The number of hours devoted to school-work is thirty-six or thirty-seven per week, according to the class. Of these hours, from twelve to fourteen are devoted to Agriculture and Natural Science. The full course of instruction covers three years, and a first-class leaving certificate from one of these schools enables the holder to perform his service in the army as a so-called "Volunteer" in one year.

The *Écoles pratiques d'Agriculture* in France have also been established upon the basis of a kind of co-operation between the State, the Department, and the Director. In this respect they stand on all fours with the German

schools; but they differ in being "boarding-schools," and in the pupils being required to work more or less on the attached farm. Another important difference is that no two of the French schools are exactly alike in their organisation. Differences of systems of culture, owing to variations in soil or climate, are allowed to have their proper influence upon the scheme of education which is thought best fitted for the future farmers of the district, while in Germany, as I have already stated, the only variation allowed by the Government, which delights, *par excellence*, in military discipline, is in the selection by the headmasters of the foreign languages to be made the subjects of study.

The following translated quotation from a circular issued to the Préfets of Departments by the Minister of Agriculture, will explain the authorised arrangement for board, instruction, and manual work, in these French schools:—

"Admission to the practical schools will not be entirely gratuitous; but the payment to be made will always be calculated in a manner to represent as exactly as possible the cost of the food and maintenance of the pupils. Their time will be divided into two nearly equal parts: one devoted to a superior primary education, to which will be added instruction in natural sciences and special subjects, and the other employed in the work of the farm attached to the establishment. But the instruction to be given will not be regulated by one uniform programme; on the contrary, it will be desirable to modify it according to the diverse cultural conditions of the several districts."

Under such circumstances it is impossible to give a general description of all the schools, and time will not allow me to attempt a special description of each one. You must, therefore, permit me to give the following main facts relating to Les Merchines, in the department of the Meuse, as fairly illustrative. The farm consists of 750 acres in a ring fence, namely, 150 woodland, 50 osiers, 250 permanent grass and 300 arable. Most of the domestic work is done by Sisters belonging to a religious body. Twenty pupils are received and pass through a two years' course of instruction, paying £16 per annum for education, board, lodging, and laundry. The pupils of each class are alternately taught in the school-room and work on the

farm, and in this way the "half-time" principle is carried out.

It is not possible to give the cost of such a school to the State and the Department, as the items are not kept separate in the published accounts; but it is quite certain that this class of school and the *Fermes-écoles*, to be presently described, make an average annual demand of £31 per pupil on the public revenue of France.

Leaving now the French and German representatives of the "School-farm," let me direct your attention to the equivalents of what I have called the "Farm-school," which also exist in Germany and in France.

In Prussia alone there are no less than 32 of these schools, known as *Ackerbauschulen*, and they differ from the higher schools or *Landwirthschaftsschulen* in some very important respects. The pupils acquire no privilege as to army service. The general education given at them is of a less advanced type, while the agricultural instruction is of a more practical character. The course extends, as a rule, over eighteen months; but in some cases it is continued for two years. About two-thirds of the schools are what we term "Boarding-schools," and the cost to the parents for board, lodging, and education amounts to about 24 guineas a year. But it should not be forgotten that this "school-fee" varies with the amount of manual labour which the pupils are expected to perform as *quasi* farm-labourers. In some cases, in fact, the fees do not amount to more than 12 guineas per annum, or about half the average sum just mentioned.

The annual cost of these schools to the community in Prussia amounts to about £17,000, of which nearly £6700 is contributed by the State, and nearly £10,400 by the local authorities. I should add that there is more elasticity, or, if the expression be preferred, less rigidity in the management of them than in those of the higher type which I have previously described. This is, doubtless, owing to the fact that, there being no question of army service involved, the Prussian Government is less interested

from that point of view; while owing to the larger subsidies given by the Provincial governments, they are proportionately more interested in requiring that the teaching given should be in accord with the agricultural wants of each district in which a school is situated.

The farm-schools of France are established on a somewhat different basis, because the whole of the subsidy generally comes from the State funds, and the instruction, board, and lodging are given absolutely without payment by or on behalf of the pupils. This is arranged as follows:—The Government pays the farmer, dignified by the name of Director, a salary of £96 per annum; and four other functionaries are paid various salaries, which range from £40 to £60 per annum each. The State also makes an allowance to the Director of £10 16*s*. per head per annum towards the keep of the apprentices, as the pupils at these schools are called in France. Another variation is that at the termination of the apprenticeship, which lasts two or three years, the young men who pass their leaving examination satisfactorily obtain the right to one year's voluntary service in the army. They also receive a certificate of apprenticeship, and a present of £12 or £24, according to the length of their apprenticeship. I may explain that this amount is supposed to represent what each apprentice should have been able to save, if he had been employed as an ordinary indoor farm-servant during the same length of time.

These farm-schools were established in 1848, and the scale of payments just mentioned was fixed at that time. Doubtless it was a fair arrangement then; but it is now considered too low by many of the directors of these schools, all of whom, be it clearly understood, must themselves take the risk of profit and loss, both as regards the farm and the school. For this reason, and owing to the greater encouragement given by the State to the "Practical schools of Agriculture," the number of the "Farm-schools" is decreasing in France. Formerly there were 40 of them, but now there are only 23. The pupils and their parents

also find the inducements held out to them less attractive than formerly, especially in the manufacturing and populous districts. This is owing to the increase in the price of labour, and to the real or fancied greater attractions of town-life.

I now wish to ask your attention to a brief sketch of the scheme which I have founded upon my experience of the school-farms and farm-schools of France and Germany, while engaged as Sub-Commissioner to the Royal Commission on Technical Instruction.

First of all, as to school-farms for the education of the sons of tenant-farmers:—I assume that all present know that several so-called "county schools" have been established for this express purpose in certain counties, largely owing to the liberality of a number of landowners, who wished to assist in providing their tenants with the means of obtaining a good general and technical education for their sons at a moderate cost. You may also know that, of the pupils at these county schools, a very small proportion belong to the class for which they were specially designed and endowed. The plain fact is, that English farmers who desire to bring up their sons in the same business as themselves — nowadays, I fear, an ever-decreasing number —do not see the value of what is termed a liberal education without any technical instruction. Theorists say, teach a boy Latin and Euclid, and he will fight his way anywhere. But English farmers will not and cannot believe that such an education will teach their boys how to tell whether a seed will produce the plant asserted, whether a manure contains the proper percentages of nitrogen and phosphates, or when, how, and why land should be ploughed, sheep shorn, cows milked, oxen fed, and a variety of other details of farm practice.

So these county schools have practically failed in their real object. No doubt they have given opportunities to parents following mercantile and professional pursuits to obtain for their sons an education which is exactly fitted for them at a small cost. But, in order to make these schools useful to the agricultural community, for which they

were provided, my idea is to attach to each of them a small farm, and to include instruction in Practical Agriculture in the ordinary curriculum—at any rate of those pupils who have attained a certain high rank in the school.

The expense of this need not be enormous. A working capital of £20 per acre on a farm of 100 acres is £2000, and some farm buildings might be necessary. The farming capital could be raised by subscription, and the Education Department should give building grants at least as liberal as those hitherto given towards the construction of schools of Art and Science.

The annual expenditure, additional to what is now incurred by the managers of county schools, would be the loss between the value of the produce of the farm and the cost of working it, including the salary of a farm-bailiff and payments to an agricultural teacher. In good seasons this item might, and indeed ought, not only to disappear, but even to be converted into a profit. There still remains, however, the cost of a small experimental field and of a botanic garden, both for purposes of demonstration. A proportion of the school-fees, aided by annual subscriptions, would cover this expense, which ought not to be large.

The need for such school-farms has been recently recognised in both England and Scotland, and it is only just that I should mention the attempts to supply the want which have already been made, and which have come to my knowledge. The Agricultural School at Aspatria, in Cumberland, has been established by a number of landowners on the following basis :—

"1. That the pupils receive a good general education.

"2. That a more complete knowledge of science and the methods of scientific study be given to all the pupils, especially to those intended for farming pursuits.

"3. That during their school life the pupils shall be prepared for their future career by receiving lessons in farm practice, and, according to their ability, take an active share in its routine."

With this view the directors have laid open their farms

for the use of the pupils, and made such arrangements that—

"1. The elder and more intelligent students shall daily receive practical lessons in farm work under their superintendence.

"2. They shall have opportunities of becoming thoroughly acquainted with the nature of soils, rotation of crops, seeds, manures, and the various distinctions of breeds in cattle and sheep.

"3. That their education shall fit them to become Farmers, Graziers, Stewards, Land Agents, or Sheep Farmers."

The "King Edward School," near Banff, Aberdeenshire, has been established by the Rev. J. Milne, who is not only a clergyman and a schoolmaster, but also a practical farmer, occuping 164 acres of land, for which he pays £320 a year rent. His pupils attend school steadily on five days of the week, and on Friday he takes them over his farm, making them take notice of the operations that are going on, while assisting him in matters incidental to his field and feeding experiments.

In the event of other school-farms being established, I shall look to the Education Department to give annually to their most successful pupils free scholarships available, according to their several grades, for either the Normal School of Science, or the Royal Agricultural College at Cirencester, or the College of Agriculture at Downton. I also look to the Education Department enabling the pupils at the school-farms to be recruited by scholarships given to the most successful pupils at the English farm-schools which I hope to see established on some such lines as those I am now about to indicate.

If one were to ask any English landlord who has been obliged to take "in hand" any considerable acreage of agricultural land, what are his greatest difficulties, some would reply, "want of capital" in the first line; but all would mention "an intelligent farm-bailiff," if not as their first requirement, most certainly as their second. Now these are the men I want to train at "Farm-schools," and my proposal is briefly as follows:—

That in each county there should be selected a good

farm, the tenant of which would agree, under certain terms, to take agricultural apprentices for a term of, say, two or three years. It would be a great advantage if, to each of these farms, there could be attached a teacher capable of continuing the general education of the apprentices, by lessons given chiefly in the evenings. The remainder of this teacher's time might be employed by him, according to local circumstances, as rate-collector, book-keeper, &c.; or he might be the master of a neighbouring school. At any rate, he should be capable of teaching the elements of chemistry, land-surveying, book-keeping in a simple way, and the elementary principles of agriculture. The apprentices should be entitled to pass the examinations of the Science and Art Department in the same way as pupils of science classes, if they desired to do so, and to earn, for themselves and their instructors, all the distinctions and rewards that are given to pupils and teachers in elementary schools and science classes.

The apprentices should be selected from the candidates who distinguish themselves most in an examination held annually in connection with that of the Science and Art Department; and to a great extent the same questions might suffice for both examinations. If the number of "elementary school scholarships" and of "science and art scholarships" were increased with a view of encouraging such farm-schools, by making a certain number of such scholarships tenable at them, they would be more likely to be established, and to work successfully. The Royal Agricultural Society of England, the Highland and Agricultural Society of Scotland, the Bath and West of England Society, and some of the larger county agricultural societies, might be induced to add to the value of the scholarships given by the Government, and supplemented by the locality.

Time does not permit me to enter into details as to organisation, examinations, prizes, and certificates; but I wish to emphasise this feature of the recommendations which I have made, namely, that the Government should place "Agriculture" on at least an equal footing, in its

Educational Budget, with "Science" and with "Art." From the point of view of Justice, which in this instance certainly is not Law, much more might be demanded. What, I may ask, are the contributions of "Science" and of "Art" to the Education Rate, and to what extent do those very instructive, intellectual, and entertaining pursuits contribute to the national prosperity? I do not in the least grudge them their wealthy endowments; but, without wishing those endowments reduced, I may ask why Agriculture, which is admittedly the most important of our industries, should not be encouraged to the same extent.

THE EDUCATION OF BOYS INTENDED TO BE FARMERS.

By S. B. L. Druce,

Of Lincoln's Inn, Barrister, and Secretary to the Farmers' Club.

Before considering the very important subject to which, in response to the request of the Chairman of the Committee of Management of this Conference, I propose to address myself, viz.: How a boy who is intended to become a farmer can best be educated for his future life's occupation, I must express the diffidence which I feel in reading a paper upon it before so distinguished and extensive an audience, for I do not forget that these papers will be published and circulated over all parts of the world—this being not merely a national but an international Conference. My only excuse for undertaking the subject is that it is one to which I have given much thought for many years past: and that the first public work in which I was ever engaged was in connection with agricultural education, when, now nearly twenty years ago, I acted as the honorary secretary to the Education Committee of the Council of the Royal

Agricultural Society of England, and so, in a very humble way, assisted in the earliest endeavours which that great Society, of which all of us who are directly or indirectly connected with farming in England are so justly proud, made towards carrying out the seventh object of its charter which is, "To take measures for the improvement of the education of those who depend upon the cultivation of the soil for their support." Since that time I have not only taken a very great interest in the subject, but I also assisted the Rev. Prebendary Brereton in his attempt (which, however, was unsuccessful) to establish a county school, after the model of the Devon and Norfolk County Schools, in my own native county of Oxford.

I feel that the difficulty of treating the subject of my paper—no slight one at any time, or at all events of treating it with anything approaching to originality, is now considerably increased by the publication of my friend Mr. Jenkins' most able and exhaustive report to the Royal Commissioners on Technical Instruction. That report, it seems to me, deals with the whole subject of agricultural education in the most comprehensive manner; and it must for many years to come form the fountain head from which anyone who deals with that subject or with any branch of it must draw his facts, and to a great extent his arguments. As a collection of facts indeed the report seems to me to be perfect, and the conclusions which Mr. Jenkins deduces from his facts, and the recommendations which he suggests from their consideration, appear to me to be in the main sound and practicable; but I have the misfortune to differ from him upon one or two of them, and upon at least one which is I think of vital importance, as I shall presently show.

In considering the subject of my paper, viz.: "How a boy who is intended to be a farmer can best be educated for his future life's occupation," it is obvious that the question of expense at once confronts us; and in this respect we may, I think, consider the boy whose education we are discussing as belonging to one of three classes, that is to say—

1. The rich; to whom expense is comparatively a minor object.
2. Those of moderate means; to whom expense is a serious object.
3. Those not well off; but who are not actually of the labouring or artizan class.

1. As regards the first class I have little to say. Let the boy, to whose parents or guardians expense is a minor object, be educated at one or other of our large public schools till he is 17 or 18 years old; let him go thence to one of the Universities, where natural science and mechanics should be his special studies; after which let him spend one or two years with a good practical farmer; and let the finish be put to his education by a couple of years at Cirencester or Downton; or, if it be considered that all this takes too much time, let the boy go to a practical farmer direct from school, without spending the intermediate three years at the University. But, in my opinion, the finish which Cirencester or Downton can give to his education ought on no account to be applied until the boy has had some practical experience on a farm; for unless he has had this, the instruction which Cirencester or Downton can give him will be of very little use to him. Let him not be like a friend of mine, who having taken a good degree at Oxford, went at once to Cirencester, and when I visited him there soon after his entrance at the College, could not distinguish between a crop of mangolds and a crop of swedes, when the two crops were growing side by side, in the month of October. In this respect, I am heartily at one with Mr. Jenkins, and with him, "I desire to express my concurrence with the opinion that facts should be learnt before principles." (Report, p. 299.)

2. I pass on to consider the case of the boy whose parents or guardians have but moderate means, and to whom expense is a serious object. I must remind my hearers that I am not taking the case only of the boy whose father or guardian is a farmer, but am considering the education of the boy who is intended to be a farmer, without regard to

his father's or guardian's occupation in life. No doubt many, perhaps the very great majority of farmers are farmers' sons, but all are not, and whether the boy whose case I am considering is the son of a farmer or not, his general and early education ought, in my opinion, to be the same. Let such a boy be sent to a middle-class school, either a boarding or day school, as local or other circumstances may necessitate. In or near towns probably a good day school may be found where the best intermediate education is given, but in most country districts no such schools are available, and the boy should be sent to a good middle-class boarding school, such as those which are known as "County Schools," or to such a school as Bloxham or Hurstpierpoint, or to a good endowed grammar school. Personally, I prefer boarding schools to day schools for boys in whatever position in life they may be; but I am aware that under certain circumstances, day schools are to be preferred. For example, it would seem foolish for any parent of the class I am now considering, who happens to live in the neighbourhood of Bedford, not to avail himself of the splendid education which Bedford School affords to day boys. The cost of the boy's education at the boarding school to which I am referring should be about £35 or £40 per annum. The cost at a day school will, of course, be much less, as the boy's board and lodging will be provided at home.

The boy should be sent to the school of which I am speaking at from 10 to 12 years of age, and should remain at the same school—for nothing is, in my opinion, worse for a boy than that his school should be constantly changed—until he is about 16 years of age. And during the whole of that time his education ought to be general and not special or technical; that is to say, the boy who is intended to be a farmer should (speaking generally) have the same education as boys who are intended for other callings in life — whatever such callings may be — commercial, professional, or otherwise. I do not mean that his education should be wholly "classical," that is to say, that

he should be instructed in Latin and Greek, to the exclusion, or practical exclusion, of all other subjects, except, perhaps, mathematics. His education should be rather such as is given on the "modern" side of a public school. Let him learn Latin, by all means, but I would not require Greek—nor that too much time should be devoted to Latin; but I would insist on French and German; and he ought specially to receive instruction in arithmetic, in which I include book-keeping; the lower mathematics (I would not have him taught differential or integral calculus, for example); the rudiments of physical science; history, especially the political history of his own country; and geography, especially — if I may use the expression, agricultural geography—that is, the distinguishing agricultural features of various countries, their exports and imports of corn and cattle, their capabilities or otherwise of agricultural development, and so on; and most especially should he be instructed in the "agricultural geography" of our colonies; and be taught to believe in, and to feel the unity of the British empire, and the interdependence of the mother-country with her colonies, and the colonies with their mother-country. His general education, in short, whilst being liberal, ought to be such as will be more or less directly useful to him in after-life. But to my mind—and here it is that I differ from Mr. Jenkins—whilst the future farmer is at school with other boys who are not intended to be farmers, on no account ought his education to be technical. That should come after he leaves school, and should not be commenced until he has received a fairly good general education.

I wholly and entirely disagree with the idea of having farms for educational purposes connected with the county, or any other middle-class schools—"school-farms"—as Mr. Jenkins calls them. I entirely agree with Dr. Merriman's opinion, as quoted by Mr. Jenkins, that "much good might be done to future farming if those destined to conduct it as tenant-farmers could receive instruction in it before entering upon it as an occupation from which to get a living" (Report,

p. 309); but I wholly disagree with the opinion that such instruction should be given by means of a farm or a "special farming department" to be attached to a school for general education, whether one of the class I have mentioned, or of any other. Such a plan appears to me to be wrong in principle, and wholly impracticable and unworkable. In the first place you would, if such a plan were adopted, limit and narrow the boy's education. You would not be educating him in the true and wide sense of the word, leading him on, that is to say, to develop and bring out his best ideas and thoughts, but you would, at too young a period of life, circumscribe those ideas and those thoughts. By the adoption of such a plan you would also, in my opinion, sever the boys intended to be farmers from the rest of the school, and so form them into a separate and distinct class; and you would thereby increase that sense of isolation and reserve, and of being different from other people, which is so prevalent amongst farmers, and which, of all things, it should be the aim of everyone interested in agricultural education to lessen, rather than augment. Why, I would ask, should the boy intended to be a farmer, learn farming at his school more than the boy who is intended to be a doctor, or a solicitor, or a commercial man should learn medicine, or law, or office work at his school? The answer Mr. Jenkins seems to suggest is this: because if you do not teach the boy who is intended to be a farmer farming at school, he is taken away from school altogether; but the boy who is intended to be a solicitor, or a doctor, or to go into an office, is not taken away. To this I reply, it would be better for the boy that he should be taken away from his school altogether, than that he should be made to feel that he is separated from his schoolfellows, that he is of a class distinct from them—that he has work to do which they have not; that the drudgery of his future life's work begins with him at school, but with them not till after they have left school. So long as the boys remain at school together let there be no such distinction amongst them. But just as in our public schools

boys who are intended for the Church, the Bar, the Army, Political life, Government offices, &c., all work together, and receive, each one with the rest, a liberal education, so in the intermediate schools, of which I am speaking, the boys who are intended for solicitors, doctors, mercantile pursuits, farming, work in banks or commercial houses, &c., should all work together; and in both cases the special and technical education should be deferred until the general school course is finished.

Again, I think the plan wrong in principle for another reason, viz., that if technical agricultural education were combined with general education one would have to give way to the other, and there is not much doubt in my mind which of the two that one would be. The special would, I think, be overpowered by the general, and agricultural education would suffer. And even if this were not so I do not think the plan would work, because you would have, as regards the farm, divided authority and divided responsibility. Which should be master on the farm, the head-master of the school or the farm manager? If the former, I doubt whether the farm would succeed as a farm (and if it was not successful it would be a bad example, and of but little use), for it is not to be expected that a good head-master would make a good farm manager; or that if the head-master had the necessary qualifications that he could give the necessary time and attention to the farm management. And if the farm manager was master on the farm, the farm would, I think, be regarded as a farm rather than as part of an educational institution; and how would the head-master retain his proper authority over the boys if in one department of his school he was not supreme? The experience of Cirencester seems to me to be an apt illustration of this contention. At first the farm there was a part of the college, but now it is separate, the farmer being a tenant of Lord Bathurst, and under covenant to allow the pupils at the college free access to the farm for the purpose of receiving instruction upon it. And this latter plan, according to the evidence of the present Prin-

cipal, as given before the late Royal Commission on Agriculture, is preferable to the former. The Principal, in answer to the question, "You think that as at present constituted the farm is as advantageous to the pupils as it would be if it belonged to the college itself?" replied, "I think it is more advantageous;" and to the further question, "In what direction?" continued: "If it were entirely under the control of the college, I presume that the Professor of Agriculture would have the management of the farm, and I think that the work both of the college and the farm would be too much for one man." So I say, I think the work of the school-farm and the school itself would be too much for one man.

Then, again, I very much question whether any such a farm could be made to pay, and if it did not, it would tend to harm rather than good. Nor do I see where the funds are to come from to provide and properly equip such a farm, or to pay its working expenses which, as Dr. Merriman very justly observes, would be higher than those of an ordinary farm. No such farm could, it seems to me, be carried on unless the boys who were instructed on it paid something considerably in excess of the ordinary school payments, and this in itself would, in my opinion, be sufficient to wreck the scheme; for the class of whom I am writing cannot afford any greater expenditure for the boy's education than the sum I stated, about £35 or £40 per annum. Lastly, from the point of view of the boy himself, I think you would be likely to give him a distaste for farming if you taught it as part of a school course. Few boys really like lessons, and that which they would easily and readily learn a few years later, when they should have left school, they would learn with great difficulty and reluctance, and therefore far less effectively if they were forced to learn it while at school.

While, however, I object to the intermediate schools having farms attached to them, and to the boy who is intended to be a farmer being taught farming while at school, I would, especially if his parents or guardians could keep him at

school till he was sixteen years old, have him taught many subjects which would be of special use to him in after-life. At some modern schools with which I am familiar, the boys have what are termed "object lessons"—that is to say, they are taught the reasons for the occurrence of many of the ordinary natural matters and occurrences of every-day life—and I cannot see why the same principle should not be applied to teaching the boys intended to be farmers something about the animals, birds, insects, soils, waters, trees, flowers, fruits, crops, weeds, &c., they will come across in after-life. If this were done, and the boys were also taught such of the elements of chemistry as are useful to the farmer, and the elements of mechanics, I think their time would be more profitably spent than in learning at school the practical details of the farm.

But when the boy of the class, of which I am now writing, has left school, the great difficulty arises as to the best way in which he should be educated for his future life's occupation. At present, indeed, there would seem to be no other course open to him, or rather to his parents or guardians, than, if he is a farmer's son, that he should be kept at home, and taught his business on his father's farm; or if that cannot be done, or if his father is not a farmer, that he should be sent to some practical farmer to be taught it. In either of such cases, the boy no doubt learns the practical work of the farm, but he learns nothing else; and what seems to me to be wanted is a place or institution at which he can learn not only that practical work, but at which he can also be taught the rudiments at least of those sciences that bear upon it. So far as I am aware there are no such institutions at present existing amongst us, and it seems to me that the lack of them is a want which ought to be supplied; what seem to be required are in fact "farm-schools"—farms, that is to say, at which the boys can take part in the work of the farm, and at which they can be instructed in the elements of agricultural chemistry, botany, zoology, geology, mechanics, and such other theoretical and scientific matters, as the farmer ought to, and indeed must,

know, if he is to hold his own in these days of fierce competition.

How such "farm-schools" can be established and when established kept up, is a difficult problem to solve. For experience has shown that the attempts that have hitherto been made to supply such institutions at a cheap rate, that is to say, at about £40 or £50 a-year for each pupil, have not been successful, and it is for boys for whom that annual sum, and no more, can be paid, that they are required. It may be said, why should not the State, or the Local Authority, step in and help. But even if it were likely that the State would aid Agriculture in this way in this country, as some Foreign States have aided her in their countries—and nothing appears to me to be more unlikely—yet the idea of State aid is contrary to the Englishman's nature; and is, I think, most certainly to be deprecated, if for no other reasons than that State aid implies centralisation, and that it is the most expensive form of aid. Nor can we look to any Local Authority for help, for that means an additional charge on real property in the shape of higher rates, and real property in England, at least in the rural districts where these "farm-schools" are wanted, cannot bear any increase of rates. We are therefore driven to private, or semi-private resources; and I think that if some such plan as that which Mr. Jenkins proposes in this respect were carried out, that is to say, that there should be county or other district "farm schools" established, the cost of their necessary buildings, and other equipments, would be forthcoming by means of local subscriptions from the influential residents or landowners in the county or other district; who, if they were not willing to give the necessary money, might perhaps take the matter up in a commercial spirit by subscribing for shares in a company with limited liability, formed for the purpose of establishing such institutions. And in this way "farm-schools" might be started in a manner similar to that in which the county schools and Cavendish College, Cambridge, have been established.

Another source from which the necessary funds might be obtained occurs to me, viz., the local Educational Endowments. If these endowments were used for this purpose, they would not be divested of their educational character; but instead of being, as they too often are, frittered away, or spent in a manner which does but very little good to the persons whom the founder intended to benefit, they would be spent in assisting in the education of the class originally intended to be benefited by them. For, as I understand, most of these endowments were originally intended to benefit not the actual poor, but those of the middle class who were not well off. But even if I were wrong on this point, I should contend that having regard to the assistance which the education of the actual poor nowadays receives from imperial and local taxes, these endowments would be more fairly appropriated to the establishment of such institutions as I am sketching out, and other kindred institutions, than to the education of the actual poor—not that the actual poor need be wholly excluded from participating in them if they were so used; for boys in elementary schools might be assisted to rise in life by means of scholarships at the farm and other technical schools, the funds for which could be supplied by these endowments.

The farm-school should be under the direct management of a farmer who should be capable of instructing the pupils, not only in the practice of agriculture, but in some at least of the scientific subjects which relate to it. For a time no doubt it would not be easy to obtain farmers capable of imparting theoretical knowledge as well as of managing the farm, but this want would I think be soon supplied, as it has been in other countries. The classes in agriculture which have now become so general throughout the country will, it seems to me, help to supply the men who are wanted for this purpose.

The governing body of the farm-school should be a committee nominated by the County Board—when such boards are established. Until they are established, the committee

should consist of some members appointed by the subscribers to the funds of the farm-school; of others appointed by the local Agricultural Society, which might well devote a part of its funds to scholarships at the farm-school; and of others appointed by the trustees of the local endowments diverted to the support of the school.

Workshops, a laboratory, and a museum should be attached to each farm-school; and the pupils should be required to assist in the actual operations of the farm—to plough, to hoe, to pitch the hay and corn, to feed and shear the sheep, to feed and attend to the horned stock, and, in short, to help in manual work on the farm and in the workshops. How much time and money would many a farmer save if he could show his men how to work, as well as tell them what to do! How often do we see a mowing or reaping-machine standing idle because the farmer himself does not know, and has no labourer on his farm who knows, how to repair some little breakage in it? If the farmer understood his machines better he would not I think be so careless of them as he now too often is. When the work was finished for which any particular machine was wanted he would carefully put that machine away under cover, instead of, as is often the case now, leaving it out in the open exposed to the weather. The very fact, too, of his understanding the mechanism of his implements would probably give him a greater interest in them, and make him more careful of them. Shortly the farm-schools which I am advocating are very similar to those which Mr. Jenkins has described as intermediate farm-schools in France, and are somewhat, but not quite the same, as those which he suggests should be formed in England.

3. As regards the third class to which the boy who is intended to be a farmer may belong, that is to say the class which is but just above the labourer or artizan, the same principles will apply with modifications. The parents of the boy in this class cannot do better than send the boy to a public elementary school, though it may be that their pride will prevent them from doing so. They cannot, how-

ever, really do better for the boy, for our public elementary schools have of late years not only become more general, but they are better in every respect than they were; and their tendency is to teach more subjects, even too high ones in the opinion of many competent authorities. In these schools, as in the intermediate schools, I would have the familiar objects of the farm theoretically explained; but on no account should there be school-farms or school-gardens attached to them for the purpose of technical teaching. The boy of poor parents should attend this school as long as possible, but at fourteen years old, or thereabouts, he will in all probability be obliged to leave, and then I would have him sent to a farm-school. But upon different terms from the boy who belongs to the intermediate class we have been considering. This boy should be apprenticed to the farm-school for the period of three, or at least two years, and in his case work upon the farm should be compulsory. For this work he should receive wages calculated at a fair rate according to the locality; and these wages should be set off against the instruction he would receive, so that the only expense which his father ought to have to incur on his behalf would be for his board, lodging, and clothes; and even this expense might be provided, or partially provided for, by means of the scholarships which, as I have already suggested, might be advantageously given to deserving boys whose parents were really in want of the necessary money.

I would further suggest that boys of all the classes which I have been considering should be allowed while pupils at agricultural colleges or farm-schools, to go over some of the other farms in the neighbourhood, besides the actual farm of the college or school, in order that they might see and become familiar with other soils, and other systems and methods of farming in addition to the college or school-farm and the system and method of farming adopted on it. I do not mean that the boys should be allowed to run helter-skelter over every farm in the neighbourhood, but that certain farms should be selected for the purpose, and

that the occupiers should be paid in some shape or another for permitting their farms to be so used.

In conclusion, I would not have it supposed that I for one moment consider that if such farm-schools as I have suggested were established they would turn out complete farmers. I have no such thought: but I feel sure that they would give the future farmer the theoretical instruction in some, at least, of the scientific subjects connected with the business of farming which would be of great service to him in his business; and that they would, at all events, open the boys' eyes and minds, and teach them how to teach themselves. Farming, as we all know, is essentially a practical occupation, but to be a successful farmer in these days practice must be combined with science. There must be hard work in the fields and there should be hard work in the study as well.

> "Pater ipse colendi
> Haud facilem esse viam voluit, primusque per artem
> Movit agros."

DISCUSSION.

Professor TOWNSHEND (Ohio State University) said that he had been requested to mention some of the methods which were in use in the State in which he lived, for the purpose of bringing scientific knowledge before the existing generation of farmers, instead of leaving it to the schools to educate the coming generation. If science was of any value, it was worth something to the farmers now living, and they could not afford to leave all the advantages to be enjoyed by their children. In Ohio they had two agencies for giving this instruction. One was organised at the State University, and consisted of a series of lectures given during the month of January every year, four lectures being given each day. January was a month in which very little farm

work could be carried on in Ohio. The State of Ohio was nearly square, and measured about 200 miles on each side, hence it contained about 40,000 square miles or 25,000,000 acres. The city of Columbus, where the lectures were given, was in the centre of the State, so that persons could come from the extremities of the State by a ride of little more than 100 miles. Six annual courses of lectures had already been given; these embraced subjects related to agriculture, to veterinary medicine, and also political economy. In addition to these lectures to farmers at the State University, Farmers' Institutes were held in other parts of the State under the auspices of the State Board of Agriculture. These "institutes" usually continue two or three days, papers on agricultural or scientific topics are read and discussed, and one or more lectures are given daily by the secretary of the State Board, or some professor of the State University. By such methods many of the applications of science to agriculture are brought to the knowledge of the people.

Mr. T. B. WOODWARD (Tewkesbury) said that he supposed he was right in concluding that the general idea of the Conference that day was to introduce an efficient discussion upon the question of what system it would be best to establish throughout the whole of England for the teaching of agricultural science. They had two very interesting papers on that important subject. In the few remarks he had to make, he had no intention to refer to the higher branches of the subject, or the agricultural colleges. He should like to put in a very strong word for the education of the small farmer class, or what was called in the Midland Counties "the lower middle class." They had heard in these discussions very nervous and hesitating remarks about State aid. If they meant by State aid State subvention, he should say that they were entirely on an unsound principle; but if they meant a sound use of the public money for the public advantage, he did not see why the State should not help in this gigantic work. He rather wished that Professor Townshend had had time to tell the meeting what he had

told him (Mr. Woodward), which was that a vast sum of money had been advanced by the State in Ohio in the interest of agriculture generally. He had not looked up the facts of history in order to make an effective speech on this important question ; but he supposed that he should be well within the mark if he said that, looking back over the history of centuries, three-quarters of our colleges and all our universities, Oxford, Cambridge, Edinburgh, London, and Dublin, had been built by the use of public money either in the hands of the sovereign or of church bodies. That was one side of the picture. What had we done within the last few years? Had we not established at the expense of millions of public money a national system of education for the working classes? That was indisputable. Where were the millions of money to be spent for the middle classes? What had the nation at large done for the education of the lower middle classes? He believed that the general question which this Conference had had the honour of starting would rise to much greater and wider significance than they were at present aware of, and that it really meant the establishment of a complete system of intermediate schools between our national school system and the universities. He believed that nothing short of that would be the ultimate issue of these discussions. Where did the children of the middle classes get their education? The *Times* of that morning, speaking in a leading article on that very question, used the phrase, "The wretched imposture provided by the cheap private schools." While the lower classes were having a sound scientific education at the expense of the State, our middle-class children were dependent upon "the wretched imposture provided by the cheap private schools." He should not have used such a strong expression himself. With regard to Mr. Druce's reference to farm-schools, it seemed to him (Mr. Woodward) that the idea must necessarily be adopted as a branch of the lower school of the agricultural college system. They could not have a separate system. Either the farm-school must be a part of an intermediate school

system, or else it must be the lower school of an agricultural college. They had been discussing at the Farmers' Club and elsewhere the desirability of having experimental stations. Why should not experimental stations be made part and parcel of the intermediate school system? He would have laboratories and workshops and small areas of land attached to the schools for the purpose of object teaching with regard to boys. He believed that Mr. Druce was perfectly correct in saying that it would be a mistake to teach boys technical education too early in life; but at the same time he (the speaker) had devout faith in what Professor Huxley and Mr. Herbert Spencer had advocated, namely, object teaching. This was a very wide question, and he must apologise for not doing justice to the very useful information which Mr. Jenkins had put before the section; but the question seemed to him not to be one in which we should copy either the French or German system, but one in which on national grounds we should complete our own system of national education.

Mr. W. C. TAYLOR (Aspatria, Carlisle) said that, after reading the two papers by Mr. Jenkins and Mr. Druce, he failed to see in what respect they differed. Their advice was very similar; that advice could not be carried out more closely than it was being carrid out at Aspatria, for in that establishment they did exactly what Mr. Druce advocated in the formation of the school by shares, and the curriculum of education under the Science and Art Department. Last year the boys were divided into the three classes, which Mr. Druce enumerated, of those who could afford to pay, those to whom money was decidedly a great object, and those who had no money at all. He was very pleased to see that the boys in the lowest standards, where they were very poor, took the greatest honours last year. The youngest boy, who was sent up to the Royal Agricultural Society, was fourteen years of age, and he obtained an open scholarship. Two years before that he came from the sixth standard of a Board School. He must thank Mr. Jenkins for giving the establishment in Aspatria such prominence

in his paper, and he hoped that their future work would certainly merit what he had said of the school.

The Rev. Prebendary BRERETON said that he had the very great satisfaction more than twenty-five years ago of selecting Mr. Thompson as the head-master of the school that was intended to be almost the first intermediate public school in England in which the wants and wishes of rural residents, and especially of farmers, were taken into account; and for more than twenty-five years Mr. Thompson had wonderfully fulfilled the expectations with which he was appointed as a schoolmaster. It was a fact that the Devon County School, which was established on the hills of North Devon with a purely rural population, had passed more farmers' sons in the local examinations of Cambridge and Oxford than any other, and won a full share of honours, thus fulfilling the expectations of many, that those persons who were connected with agriculture would by no means be found to be those who attach least value to education. With regard to the whole subject of intermediate education in England, to which the former speaker had referred, he (Prebendary Brereton) should like to be allowed to remind the meeting that in England we had certain peculiar public funds, in which respect we differed from other countries. England was the only country which had got a poor rate, and we were almost the only country which had got endowments such as those to which Mr. Woodward alluded. The fact that the Charity Commissioners were administering an income of over two millions, implied that they were intrusted with a capital of some sixty millions. That capital alone would be enough to establish every school in England if the schools could be all made self-supporting, like the Devon County School, which for the last fifteen years had paid an honest *bonâ fide* dividend upon the capital. He should say that nothing would be better for England than that the Charity Commissioners should be authorised to advance the capital for such schools as would pay the interest, which should be applied according to the wishes of the donors for the poor of every class.

Mr. WOODWARD: Where did you get your original capital from in Devonshire?

Prebendary BRERETON: We subscribed it. And I may say another thing. When I first went to reside in North Devon the farmers of my parish represented to me that they felt very much the need of a better school in their parish, and they gave me a voluntary rate of *4d.* in the £ in order to improve the education.

The CHAIRMAN: Thirty years ago?

Prebendary BRERETON said it was thirty years ago. Therefore he was perfectly certain that the agriculturists of England were in earnest in wishing to solve this great problem. As had been pointed out by Mr. Druce, their object was not so much to provide for future farmers as to provide education for farmers' sons; but incidentally the question of how the future farmers might receive the education which would best help them in their profession had of course pressed upon them. He had had the advantage of being Chairman of the Norfolk County School for some time, and the matter had been discussed there. They had thought it most important that county schools should be thoroughly established as supplying a general education, and that it would be a mistake to introduce special or technical departments before the pupils were thoroughly established in their general education. He believed that in a large school where there was a great number of teachers, they might somewhat anticipate the divergence from general education in the school, and bring into the general culture those special studies which would most help a special profession. Many local endowments which were now abused might most beneficially be applied for the purpose of technical education. A number of the doles which were now given did infinite harm. Where money had been given by the liberality of our ancestors, and was now doing no good, he did not know a more useful function for it than the solution of this great problem by connecting scholarships with public institutions as a means of giving technical education where it was so much wanted.

He thought that in that direction Mr. Jenkins and Mr. Druce might co-operate in the work which the promoters of county education had been attempting to carry out. It seemed to him, however, that Mr. Jenkins entered in the last paragraph upon a matter to which we in England could give no affirmative answer. He drew attention to the money which Government was spending on science and art, and said, "I do not in the least grudge them their wealthy endowments, but without wishing those endowments reduced, I may ask why agriculture, which is admittedly the most important of our industries, should not be encouraged to the same extent." A Government grant to things which benefit all industries was a very different thing from a grant to even the most important of the industries; and while he quite acknowledged that in England agriculture was one of the most important of the industries, and that, compared with the agricultural world, English agriculturew as still the leading industry, yet it was not true that England was only an agricultural country. It was a commercial country, and we must take sounder views. Agriculture ought really to support itself, and ought to be glad to contribute liberally to the science and art of the country. His experience of the farmers of England was that they were capable of entering into right ideas with regard to education, and thought that those who paid their own money to educate their own children, would educate them better than the State can ever do. He hoped that English agriculture, the most important of the industries, would not lose its generous and proud feeling of self-dependence.

Professor WRIGHTSON said that the subject of the afternoon, which was the education of the lower classes of the agricultural community, was not one upon which he had any real experience at all, although he had had considerable experience with reference to higher education. He would express his own acknowledgments and thanks to Mr. Jenkins and Mr. Druce for their very able papers. He certainly thought that the slight differences between

them were not of a very serious nature. It appeared to him that the chief differences between them lay in the question of age. He presumed that Mr. Jenkins would introduce technical instruction in agriculture a few years earlier than Mr. Druce would think it advisable that special instruction should be given. We must remember that there was a truly educational element in the study of the natural sciences; and while it was only at a later period that those sciences could be rendered totally technical, and made applicable to a subject such as agriculture, there was no reason why they should not also be used as a method of truly educating younger boys. While the elements of chemistry and physics and a knowledge of botany and geology might be used for educational purposes, that same knowledge might be rendered a little more technical as time passed on; and thus both ideas could be brought into harmony. Another point had struck him with reference to this subject. It appeared to him that both the initial expense and the annual expense were very much underrated both by Mr. Jenkins and Mr. Druce. He had had very considerable experience in providing technical instruction, and it was a very expensive kind of instruction to provide. When he heard, as he had heard that morning, remarks made almost twitting Cirencester and Downton with the high fees which they charged, he felt that he wished that the gentlemen who made those observations could be behind the scenes in those institutions, for then they would see that the cost was very great. They could not provide good teachers in science, laboratories, museums, a veterinary department, and a farm, without a very serious expense, and it must be also remembered that although these things grew, yet the first year, the second year, and the third year, the expense was perhaps £200 per student. If he had 100 students he divided the standing expenses by 100. If he had 50 students he divided the standing expenses by 50. They went a long way towards halving the cost per head by doubling the number of students. As he mentioned in his paper that morning, he believed that the

demand for agricultural education was most lively in the upper classes. The landlords and gentry of this country had appreciated the value of technical instruction, and they had come forward and they had supported at least two colleges. That was the solution which they were asked for that morning. There were two colleges for the purpose of the higher education. But they had to create a demand for the education of bailiffs and small farmers. Did anyone think that bailiffs and small farmers would give £45 a year for having their boys provided with food, washing, and general teaching? No; they would want it done for nothing. It was not very long since a clergyman wrote to him to ask upon what terms he (Mr. Wrightson) would take hi son; and he inquired whether he would take him and pay him a small salary. He said that he was a very good boy, and he had no doubt that he would be most useful on the farm, and he would come to the college if he was allowed a little pocket money—£10 or £12 a year. He believed that the small farmers would want the schools to pay their sons a small sum for coming, instead of being willing to pay £45 a year for the education of the boys. He thought that Mr. Jenkins must be very fully aware that in every school in Europe which was reported upon in his own report and in the other reports of the Technical Commissioners, a very large number of sciences was generally spoken of. This was a matter under dispute. Sir Thomas Acland seemed to think that too many subjects were taught, but that was not the opinion of the educated world; and he ventured to think that it was a mistake to suppose that any subjects which were taught in agricultural colleges ought not to be taught there. The subjects must be taught well. He was astonished to hear it stated in one paper that the technical school was to be conducted by a farmer, and that that farmer was to teach science. It appeared that he would be required to be a man who could manage a farm, teach science, act as the curator of the museum, act as master of the veterinary department, and superintend the workshops.

Well, they could not get such a man. (A voice: "Make him!") Neither could they make him; and not only that but no two men could do it, and no three men could do it. It would require a proper staff, and that staff, or faculty as it ought to be called, ought to approach to a university. Such a faculty could not be set up in a small school. There must be State aid in the matter. Although Mr. Druce was very hopeless with regard to State aid, he was himself much inclined to take the view which had been expressed by another speaker, that there were abundant funds in this country, and that the occasion was perfectly worthy of the application of those funds. He believed that men of wealth would pay the fees cheerfully. They liked to pay rather high fees for other reasons than the value of the education received. They liked their sons to meet with young men of their own class. Therefore he concluded that in connection with the higher education there would be a demand which would make the system self-supporting; but in connection with the education of the middle classes we should require State aid in some form or other. The idea of State aid in his mind was more in accordance with a larger institution than had been sketched out, although he was not going to say that the institution would need to be a large one. The farm schools and school farms might all be grouped under supervision; and it might be that there should not be very many young men placed together, though they should all be under a common Ægis. Whether there should be a large institution of a general character, with a handsome building more of the character of a university, or whether there should be separate ones, was a question which was quite worthy of consideration, but he believed that in either case the institution would need to be subsidised.

The CHAIRMAN (Earl Fortescue) hoped that as he had to leave the meeting, he might be permitted to say a word out of his turn. The paper which he read yesterday would show that he did not wholly agree with Mr. Jenkins, though he quite recognised the ability with which Mr. Jen-

kins had put forward his views. On one point he must be allowed to correct Mr. Jenkins from his own experience. Mr. Jenkins spoke of the failure of the County Schools, because farmers wished to have technical instruction from the first. He (Lord Fortescue) was present when the question of the best scheme for adoption in the proposed Devon County School was originally discussed by a number of the neighbouring farmers and gentry, who were collected together by his father to consider the expediency of the establishment of such a school. Various suggestions were made, but the one thing in which they all agreed most positively was that there was to be no technical instruction. The boys were to have a good general education, but any special farming instruction was held to be most undesirable. In short, the meeting would not hear of it. His own belief was that, if the sons of farmers did not come to the County Schools, it was not because they wanted more technical instruction. He was speaking of twenty-seven year ago; but at the same time he believed that agriculturists, though they might possibly have modified their views to a small extent, and might recognise a certain amount of specialty for those about to enter upon a special vocation, did not now desire special technical instruction at school for their sons. He did not know at what age Mr. Jenkins intended the pupils to enter the school-farms.

Mr. JENKINS: I put it according to their status in the school, not their actual age. That would be a hard and fast line, which I should not adopt. When a boy gets into the sixth form, he begins to get technical instruction.

The CHAIRMAN said that of course there were differences in the progress made in their studies by different boys of the same age, but it was not even mentioned that these were to be the head boys of a second-grade school, at which the education generally terminated at sixteen to seventeen. He felt quite at sea when he heard Mr. Jenkins's paper. Very much depended upon the period at which the general highway of education was quitted to a certain extent, for the special byway of the future occupation

2 M 2

of life. His own leaning was much more to Mr. Druce's view; and he must say that he deprecated the amount of State aid and public intervention and management which was shadowed out, or even more than shadowed out, in Mr. Jenkins's paper, and openly called for by Mr. Woodward. He had a very strong conviction that, even if it started well, it would become undesirable for two reasons. The tendency in Government management and concerns of all sorts was to routine. Education which was stationary would become practically retrograde. The other reason was that, when an institution was new and public attention was concentrated upon it, the best men were got for the place; but after that, claims of all sorts—private, public, and party—were recognised, and a place would have to be found for a man rather than the right man for the place. Mr. Woodward had further said that the County schools were a wretched imposture. He thought that that had been sufficiently answered by his friend, Canon Brereton.

Mr. WOODWARD: Pardon me, my lord; I spoke from the 'Times,' and I said the chief private schools.

The CHAIRMAN said that he must have misunderstood Mr. Woodward. He quite admitted that there were a great many private schools that were great impostures. He always looked upon it as a suspicious feature in a school when it declined to submit the majority of its pupils to an impartial examination.

(Earl Fortescue then withdrew, and was succeeded in the chair by Lord Reay.)

The CHAIRMAN invited Professor Townshend to make some further remarks, and to give the Conference some facts and figures with regard to State aid to education in Ohio. They all knew what was the significance of America to the agricultural world.

Professor TOWNSHEND said that the State University of Ohio was based upon a public land grant. In 1862, the General Government gave to all the States certain quantities of land for agricultural education, or, as it was said, for the *liberal* education of the industrial classes. There was already

an abundance of colleges, but they were literary rather than scientific or industrial, and of these there were about thirty in the State of Ohio. Such colleges confined their work largely to the professions, and the industrial classes got very little benefit from them. Under the grant of 1862, the General Government gave to the State of Ohio a quantity of wild lands proportioned to its population. About 500,000 dollars were raised from the sale of this land, and the country in which Columbus is located gave 300,000 dollars more to secure the location of the university within their borders. A farm of 350 acres was purchased with a portion of the money, and the requisite buildings for a university were erected, the remainder of the money was invested. The income of the investment amounted to about 35,000 dollars a year, and that paid the expenses of all the professors of the University, some twenty in number. If the University funds ran a little short, they went to the Legislature and asked for ten or twenty thousand dollars; and it was generally given. They had obtained special grants for their library, their botanical buildings, and their chemical and mechanical laboratories. They were always wanting something. The University worked in harmony with the common school system. They did not admit a young man to the University unless he had obtained a certain grade of scholarship. As soon as pupils got the requisite position in the school, they brought a certificate, or, if they had no certificate, they were subjected to an entrance examination, and passed or failed according to their ability. The annual stipend of each professor was about £500 a year; and as this was paid from the income of the University, the students were charged nothing except a small sum for incidentals. The young men boarded themselves, and bought their own books. The General Government made it a requisite that the University should teach military drill. This was conducted by a Government officer, and did not cost the University anything. All the male students wore a blue military uniform, which could be purchased very cheaply,

as it was made in a wholesale way. There were about 300 male and 40 or 50 female students in the institution. The advantage of the uniform was that all the students were on an equality as far as dress was concerned. The poorer students were employed in doing work upon the farm, and were paid a liberal remuneration for their services.

Brother NOAH (of the Christian Brothers) called attention to the exhibits of the farm-school of the Christian Brothers in one of the rooms of the Exhibition. There was one reason why Englishmen should take an interest in that farm-school, which was that it owed its foundation, to a great extent, to the generosity of the late Prince Consort, whose name was dear to every Englishman, and to many Americans. He sent from his own estate many animals and implements, to enable the Christian Brothers to start their establishment at Beauvais, in France, one of the least cultivated districts in the country. The model-farm school had, during the twenty-nine years of its existence, received 250 gold and silver medals. The pupils were taught the routine of farm work, and they were all put on the same level. In that way the managers prevented many of those little bickerings which, by the way, were more likely to arise in a republic than under any other form of government, although they professed to be so democratic. If one went to America, he would find more aping of what was called "the higher classes," than was found in England. The reason was that in England the nobility were at home, whereas in America people often made themselves ridiculous by wanting to be what they were not. Things were certainly not what they seemed.

The CHAIRMAN (Lord Reay) said that, unfortunately, he had been prevented from attending the meetings of this section, although he thought that in hardly any section subjects of greater importance to the future of England, Scotland, and Ireland, could have been discussed. In his opening address, he had said what he thought about this question of technical education in agriculture. He would

not have dwelt on it as he did if he were not fully aware how much there remained to be done in England and in Scotland. There was overwhelming evidence on the subject. The Governments of Germany, France, Belgium, and Holland, all gave grants for agricultural education. What was the amount of money spent on it in the United Kingdom? That was the real question. He did not care from what source the money came. If they could get it from the Charity Commissioners, well and good. One of these Commissioners told them in another room that they must not expect that their capital, which had been described as so large, would be able to supply all the claims which had been put forward that week. Educationists must not delude themselves about that. Therefore they had to face the question, How was this great want of agricultural education to be met? The question was a very serious one. He quite agreed with Prebendary Brereton, that it did not stand by itself. They could not supply the wants of the agricultural community without considering the wants of the middle classes generally, and especially what had been called the lower middle classes. But this he would distinctly say—that if there were any wants which had a claim and a right to be considered, they were, undoubtedly, those of the lower middle classes in this cry for education. There was a conviction at the present moment that we were doing so much for other classes of the community, that the lower middle classes would not be able to hold their own That would be an immense disadvantage to any country. He considered that the lower middle classes were really the backbone of the community. The Technical Commissioners, by taking up the subject of agriculture, had shown that the agricultural question was a part of the education question which would have to be dealt with ere long by the Government. He was extremely pleased that the Report recognised the fact that, when they were going to look into the education of our merchants, manufacturers and engineers, they would also have to look into the question of the education of our agriculturists as a part of the

community, with the same rights. In England the mischief had been that hitherto our education had been running too much in one groove. We had endowments for learning Latin and Greek, which were of very little use. If the work of technical education in agriculture was to be done well, distinct schools must be provided so that the lower middle classes could make use of them. If this education were made expensive, a supply would have been created for which there would be no demand. Therefore the education must be good and cheap.

(Lord Reay then withdrew from the meeting, and the chair was taken by Mr. St. John Ackers.)

The Rev. J. H. THOMPSON (Head-master of the Devon County School) said, that as the head-master of the first established county school, and having been at its head from its commencement to the present time, he had intended to make one or two remarks, but it was hardly necessary for him to do so after what had been stated by Lord Fortescue and Prebendary Brereton. Mr. Jenkins had said in his paper that county schools had failed in their real object. Before making such a statement, Mr. Jenkins ought to have been quite sure that he knew what their real object was. He had seemed to imply that their object was almost exclusively to supply a good general and technical education to the sons of tenant-farmers. In a paper which he (Mr. Thompson) wrote in 1859, he endeavoured to point out as clearly as he could that the county schools were not intended exclusively for the sons of farmers, but that they were open for anybody in the county. Otherwise the name would have been a misnomer. When the Devon county school was first started, a well-known farmer in North Devon said, "It will be a great mistake if you let it be supposed that your school is for the sons of farmers. Farmers wish their sons, when they go to school, to mix with the sons of members of other professions; and if you let it be supposed, that your school is intended almost exclusively for the sons of farmers, the very people who will not send their sons will be the farmers themselves." Mr. Jenkins

seemed to suppose that county schools had, as he said, practically failed, because they had not set about teaching the farmers how sheep were shorn, cows milked, and so on. Now the great difficulty in attempting to introduce any of the elements of technical education had always been the strong, resolute, persistent opposition of the farmers themselves. As Lord Fortescue had said, that was the case at first. That had been the case whenever any attempt had been made since. The reasons that the county schools had not been so successful as it was supposed they might be, were, first, that there had been the great revival of grammar schools within the last twenty-five years, and secondly, that farmers were more and more sending their sons to the board schools. These things had very much to do with what Mr. Jenkins called the failure of county schools. He (Mr. Thompson) did not admit that they had failed at all, and still less did he admit that they had failed for the reasons stated by Mr. Jenkins.

The Rev. C. O. TREW (Head-master of Gillingham School) said that he was head of what had been described as one of the younger grammar schools, or a school which had been recently organised. It was a school which offered a full and complete education for what might appear to some the ridiculously small sum of £33 a year. Gillingham was one of the most important and largest markets in Dorsetshire, and was the centre of a very large industry chiefly in milk and butter. If he might be allowed to differ from such a paper as the *Times*, he would say that if the lower middle class schools were not properly utilised, he was very much inclined to think that it was the fault of the middle classes themselves. He believed that there was a religious feeling which entered into the maintenance of the private schools. A leading Nonconformist, who lived near him, told him that he was obliged, for denominational reasons, to send his son to a private venture school where the education was not so good as he should wish. He thought that that fact partly explained the influence of such private schools. Those schools were,

however, going to the wall, and grammar schools and county schools were coming to the front. Mr. Druce had said in his paper that middle class schools should teach Latin and mathematics, but principally French and German, and had thus supposed a very large amount of home education on the part of the boys; but home education was what they did not get. He (Mr. Trew) had asked one of the boys at his school how many oysters would be required for a supper party of twelve, and the boy answered "two." Another boy had told him that Salt Lake City was on the Dead Sea. The boys who came to the school had not the slightest idea of the scientific facts which governed the rise and fall of the barometer. He had taught them the elements of chemistry and mechanics. He kept bees on the school premises, and it was surprising how eagerly boys took up knowledge in connection with such matters. They tried experiments on potatoes with various manures. It was surprising to see the eagerness of boys about machinery. There was enough about the common pump as a basis of teaching the boys a good deal of science. The farmers would not object to teaching of that sort. He believed that they wanted their boys to be practical.

Mr. J. K. FOWLER (Aylesbury) said that something had been said with regard to the withdrawal of funds that were in the hands of the Charity Commissioners, and he really thought that some of those funds might be fairly and reasonably used for the purpose which the section was then considering. He therefore differed from Lord Fortescue in that point. He thought that it was not unnatural that the farmers of England should ask for some little support of that kind when they were educating the whole of their agricultural labourers at their own expense, either by private subscription or a School Board rate. There was nothing unfair in the agriculturists of the country asking for some support for the education of their sons. There were many endowed schools which had been lately brought to light. He knew one especially at Felstead, in Essex, which, up to a few years ago, had a paltry £80 a year to support it. It was

then discovered that that was not only a rent charge, but it was the value of the whole estate at the period when it was given, which was by Lord Rich, in the time of James I. The estate had now been recovered to the school, and he believed that it was worth between £1200 and £1500 a year, which was now the endowment of that school. The school now ranked as one of the great public schools of the day. He hoped that it would not go forth to the world that the tenant farmers or agriculturists of England were deficient in agricultural education. When they came to consider that that much-lauded country, America, with all its wonderful education, grew only from 13 to 16 bushels of wheat an acre, whereas English farmers, on an average, grew from 28 to 32 bushels an acre, that fact would perhaps redound a little to the credit of the farmers of England, who had educated themselves, and who had spent a very large amount of money in educating the people around them. When he was at the Exhibition at Vienna, he was on the jury on the occasion, and Professor Wrightson was also one of the jurors. The night before their services were to be rendered there was a meeting at which about ninety-nine persons were present. There was one Englishman in each jury. An address was delivered to the jurors in German, and a gentleman opposite said to him, "You do not understand what the speaker has said?" He (Mr. Fowler) replied, "Not one word." The gentleman then informed him that the speaker finished his speech with these words, "If you are in any doubt in any of your departments, immediately give way to the English judge." He thought that it was necessary to say that they, as farmers, were most desirous of educating their sons even perhaps more than was practicable, and he would strongly support a classical education for boys. He was decidedly for that, and he went farther than Mr. Druce. He would teach not only Latin, but even Greek. It was one of the means by which the farmers' sons of the day would be enabled to hold their own. Otherwise they would be run

over in the great race with the boys of the Board and National Schools.

Mr. MACNAB said that he came from Scotland, and he would say a word about the experience of that country. The question seemed to be raised whether an agricultural education should be given to the farmers of England at the expense of the State. In Scotland they had solved a similar question in a rather remarkable way. So far back as the year 1790, a number of landed proprietors and nobles in Scotland associated themselves together in the name of the Highland Society for the improvement of agriculture. They subscribed handsomely to the society, and a great many of the tenant farmers did the same. That society now held a large capital, and was leading the agricultural education in Scotland. It provided experimental stations, conducted by paid professors. Farmers who wanted soils analysed sent them to the chemists of the Highland Society. Was it not an extraordinary thing that when a poor little country like Scotland had done this for 100 years, a large wealthy country like England had not thought of doing something of the same kind? He thought that at this time of day, it was very unlikely that any demand for agricultural education would be listened to. There were so many taxes levied that the idea of going to the State for aid to agricultural education seemed to be quite idle and improper. But there were accumulated funds in the country, and he agreed with the speakers who suggested that a portion of the money in the hands of the Charity Commissioners should be appropriated to agricultural education. All he wished to point out was that Scottish agriculture had raised itself to its high pitch by the voluntary efforts of the landed proprietors and tenant farmers. He thought that the efforts of educationists should be of the same character.

Dr. O'REILLY (of the Christian Brothers) said that he was quite at a loss to understand the statement which had been made, that a knowledge of the classics could

subserve the agricultural interests of a country. He thought that a knowledge of chemistry, especially of agricultural chemistry, and experimental physics, including, of course, a thorough knowledge of the barometer and of weather charts, would be of far greater advantage than all the lore contained in the *Works and Days* of Hesiod or the *Bucolics* and *Georgics* of Virgil. An allusion had been made to the school of Beauvais. Two weeks ago, being in France, he went over the Agricultural Institute at Beauvais. Those only were admitted to follow the courses who gave evidence of a good elementary education, by satisfactorily passing a preliminary examination. Gentlemen who held the degree of Bachelor of Arts, or of Science of the French University, were admitted without that preliminary test. The usual age for admission was seventeen. It had been found that the age of seventeen should be maintained as before that age boys could scarcely acquire that grasp of subjects which would enable them afterwards to build up a very good and lasting superstructure of agricultural knowledge. The courses extended over three years, and were of a thoroughly practical character. The whole morning was devoted to work in the class-room and in the physical and chemical laboratories of the institution. The afternoon on suitable days and seasons were devoted to work on the model farm. The farm contained 325 acres, and had been favourably reported upon by H.M.'s Commissioners. It was situated about half an hour's walk from the school. On the occasion of his visit, the students were gathered round one of the Professors who was explaining the mechanism and uses of a special kind of plough. After the explanations, the efficiency of the plough was practically illustrated in various parts of the fields. Besides working on the farm, the students were obliged to attend all the exhibitions in the vicinity which had a direct bearing upon agriculture. They studied botany, geology, and entomology, in the fields. They wrote out reports upon all that they had seen, as well as several theses on agricultural subjects. When they had gone through the full course, they received

a diploma of aptitude to conduct or superintend farms and estates.

The CHAIRMAN (Mr. St. John Ackers), in closing the discussion said that it would be superfluous for him to make any remarks upon Mr. Jenkins or his paper. That gentleman was too well known to the agriculturists of this and every other country to require any comments of his (the Chairman's) to add weight to his paper. He wished to allude again to the very eminent services which Mr. Jenkins had rendered to the country by his report as an assistant commissioner to the Royal Commission on Technical Education. He regretted that Mr. Jenkins was not in his right place on that Commission. Instead of being an assistant commissioner, he regretted that it was not found to the minds of those who appointed that Royal Commission to put upon it those persons who were thoroughly able to carry it out, and whose views would have been thoroughly trusted by agriculturists and farmers at large. Referring to the last speaker, he must heartily thank that band of brothers who had shown in Room No. 5 what might be done by union, hard work, and honest lives. He need not say that he alluded to the Christian Brothers. Anybody who had studied that room, and studied their works in every part of the world, would indeed find something to be proud of in humanity. When he was himself travelling abroad in several countries, there was no country which he came across in which he did not find the works of that brotherhood. If all brotherhoods were like that, he did not think that we should have so much said about men banding together, or women either for the matter of that. With regard to Professor Townshend, although he was a foreigner and an American, at one time he was an Englishman. They thanked him for the information he had given, but interesting as it was, it was not altogether of the character expected by some who had spoken. What he had stated was very much against certain views expressed in this section. It seemed that, in Ohio, whenever *they* wanted money they sent in their "little bill," and it

was met by the Government of that State. With regard to the forecasting of the weather, there was a gentleman present on the previous day who said that he could always forecast it. He (the Chairman) wondered that that gentleman had not made use of his knowledge for his own benefit first and then of his fellow-countrymen at large. It must be remembered that America was a huge continent, and that they had an excellent system of telegraphing the weather in all parts of the country to one particular centre, from which the information was distributed. This system was most valuable and did an immense amount of good. England was, however, an island, and we could not have stations all over the Atlantic, although at different places we did something at the present time in the way of weather forecasts. But he feared that if we attempted such a general system as in America, it would be more misleading than advantageous. If, however, more could be done he was sure that it ought to be done. The Chairman concluded with a vote of thanks to the readers of the papers, and this was carried by acclamation.

Mr. JENKINS said that he had listened with very great interest, pleasure, and instruction to the discussion which had arisen on the papers, and which had resolved itself into something like four sections, namely, one with regard to general education ; another with regard to agricultural education ; another with regard to the financial questions involved ; and a fourth with regard to the subjects fitted for educational purposes. He proposed to leave on one side all reference to questions of general education and the higher agricultural education. As to the financial questions, he would merely remark that so far as his proposals were concerned there was a certain amount of misapprehension, for he had not asked for State aid wholly, but only for a certain amount of State aid, chiefly as payments for results to schools to be established by means of local and voluntary contributions. On that point he should like to remark that if a report of what Mr. McNab had said with reference to the Highland and Agricultural

Society should reach the directors of that venerable institution they would be so astonished that they would doubtless invite him to repeat them at one of their meetings. There was scarcely any subject of discussion, except politics and religion, on which differences of opinion prevailed so greatly, as on the best means of education; and the speeches that had been made that afternoon had, as might have been expected, very nearly answered one another. He would therefore like simply to contrast some of the views put forward by Mr. Druce with those put forward by himself. He hoped that Mr. Druce would pardon him for saying that they looked upon the subject from different sides. Mr. Druce looked upon it from the point of view of the "stay-at-home young man," and he (Mr. Jenkins) looked at it from the point of view of the "going-abroad young man." For that reason he had drawn his illustrations from the known successful results of school farms and farm schools on the Continent of Europe; and as had been stated by Lord Reay, in every country round us there were such schools as those he had attempted to describe; but those which he had proposed were rather grafts on to our existing institutions than totally new departures. Some of the gentlemen who had spoken, notably the Rev. Mr. Thompson and Lord Fortescue, controverted his expression of opinion that the county schools as they existed at present had totally failed for the purposes for which they were intended. When he was sub-commissioner under the Royal Commission on Technical Instruction, he wrote to the head-master of every county school in England with which he could become acquainted, and the almost complete consensus of opinion was expressed in the phrase he had used. It might not be so in Devon, but he was sure that it was so with reference to nine-tenths of the county schools of the country. As regarded advanced schools, Mr. Druce seemed to be practically at one with him; but where they did seem to differ was with regard to attaching a school to school farms. Mr. Druce, however, had in his paper used in a literary way the

American process known as "whittling," and by whittling he had reduced the difference between them to the comparatively minor point as to whether technical instruction should be in any sense practical, or should be confined to theoretical instruction in the class-room. He agreed entirely with what had been stated by the head-master of Gillingham, that instruction in the class-room alone had not nearly the same amount of influence on the mind of the pupil as it would have had if it had been accompanied with instruction on the farm. He agreed with Mr. Woodward that if it were possible to engraft these intermediate schools upon the existing agricultural colleges, supposing that enough of them existed in the country, it would be a very desirable thing to do; and probably the result might eventually be, if such schools for higher agricultural education as had been suggested in that room come to be established, that the school farms and farm schools might be institutions existing in the same buildings, or otherwise connected with them.

Mr. DRUCE said that until the Chairman spoke he was under the happy impression that there were but very few criticisms on his paper, and that the speakers generally were rather in accord than discord with himself. So far as he could gather, the only speaker who seemed at all to dissent from him was the Rev. Mr. Trew. He understood him to say that he could not understand how the subjects he had enumerated could be taught at school. He (Mr. Druce) thought that he had been very moderate. He limited his subjects very much. He had said: "Let the student learn Latin by all means, but not give too much time to it." The student was not to learn Greek at all, but he was to learn German and French. Those were the only three languages. He should have very much liked to have been at school under the reverend gentleman. He had had a classical education. He learnt Latin and Greek continually, very little French, no German, and hardly anything else except mathematics: but he had plenty of time to learn all that. He did not want the boy to learn the

higher mathematics. He distinctly said that he only wanted him to learn the lower mathematics. With great submission to the reverend gentleman, he thought that there was plenty of time in the boy's school life to learn what he proposed. If they compared his list of subjects with that put before them by M. Gillekens in the paper which was read on the previous day, or with the list which Professor Wrightson put forward to be taught in an agricultural school, it would be found very moderate. The reverend gentleman made the meeting laugh with the answers he quoted to the questions which he asked. The question "How many oysters ought you to provide for a party of twelve?" he was bound to say was a terrible poser to him (Mr. Druce). When he dined out he found that some of his friends put half-a-dozen in his plate, but others four, and he had a friend who always could do two dozen. As to the other question: "Where is Salt Lake City?" evidently the boy who answered that it was on the Dead Sea was a wag. One of the main points which he wished to impress upon the Conference, and which he flattered himself was the only novel point in the papers, was his advocacy of the diversion of some of the local endowments to intermediate education; and he was happy to find that one speaker after another agreed with him in general terms on that point, and that they thought that the farmers had a fair claim to ask for that diversion. With regard to State aid, there had, he thought, been a little confusion in the minds of some gentlemen who had spoken as to what was meant by State aid. By that expression he (the speaker) meant a direct grant from the State. He thought that farmers could only fairly ask for State aid, as he understood it, for their experimental farms or experimental stations; and it seemed to him that they had a fair claim to ask for it for that purpose, on the ground that other industries of the country had not only asked for it but had got it for similar purposes. Why did not this great industry of agriculture get it? Over and over again yesterday their Chairman told them of what

had been brought to his knowledge with reference to the lace manufacture of Nottingham. That industry was rapidly falling away, and was going to the manufacturers in France. The Nottingham manufacturers put their heads together and went to the Government, and said: "Let us have a technical school for lace manufacturers." They obtained it, and they were recovering their position. Why should not the Government do exactly the same thing for farmers, by giving them experimental farms where they could learn what to do and what to avoid? He deprecated State aid, however, for the education, strictly speaking, of farmers, for, as he said in his paper, State aid led to centralisation, and that led to education becoming stereotyped. If they did not advance they must go back, and State control, tending to check advance, must of necessity cause them to retrograde. That was his great reason for deprecating State aid, except for experimental farms or stations.

The proceedings terminated with a vote of thanks to the Chairman.

SUBSIDIARY AIDS TO INSTRUCTION.

FRIDAY, AUGUST 8, 10 A.M.

Chairman: Dr. GLADSTONE, F.R.S.

SCHOOL MUSEUMS

By Rev. T. W. JEX BLAKE, D.D.,
Head Master of Rugby.

School Museums will be of two kinds, representing respectively Science and Art, as the great national institutions at South Kensington.

Let us notice that branch first which has first been recognised in the liberal education of England, Science.

We must pre-suppose that the School has long had Science systematically and closely taught, not necessarily to all, but presumably to at least half its pupils; or the Museum, however well-stored, will be of no use and of no meaning.

We must pre-suppose, too, that there is a good living human organization; for instance, a Natural History Society, as at Rugby, meeting once a fortnight, for an hour and a half in the evening, when the days are short; and enjoying liberty for field-work and excursions, in the Summer Term.

Our Nat. Hist. Society consists of a President, always a Master, about 120 members or associates in the School;

three or four other masters, about 50 corresponding or honorary members, with two or three old Rugbeians resident in the town; notably Mr. M. H. Bloxam, the well-known writer on Architecture and Archæology, and Mr. G. M. Seabroke, the well-known Astronomer, Curator of our Observatory. I append a notice of the work of the Society, Appendix A (page 553).

With such a living organization beside it, a Scientific or Natural History Museum will be very useful, attracting many boys to spend some of their leisure studiously, and enabling a few to develop real intelligence, and to acquire real knowledge, outside the main studies of a school, and to become in time first-rate observers and thinkers.

Such a School Museum should be—

1. *Typical:* containing type specimens of the chief divisions in all departments of Natural History. These types should be so arranged as to exhibit at a glance their distinctive characters; and should be available as illustrations of Natural History lessons and lectures; for which purpose the Museum should be, as ours is not, close to the Science Schools.

2. *Local:* containing collections of all Natural History objects found in the neighbourhood. These collections should be made by the boys themselves, to whom the work of collecting and incorporating, really, is a scientific education; and for whom merely the re-arrangement of collections, on improved systems of classification, is constantly instructive. The faculty of observation of the outer world of nature, with its infinite variety and inexhaustible interest, will be strengthened by such work; and collectors will be enabled to name their own specimens by comparison with the objects in the Museum.

3. *With Library attached:* comprising books in at least all the Departments of the Museum; mainly, books of reference, to be used in connection with the specimens themselves, and not to be removed from the Museum.

4. *With Collections always accessible:* so that supervision should be restricted to the prevention of loss and of wilful

damage. To this accessible utility the perfect order and tidiness of a locked up Museum should be promptly sacrificed.

5. *With ancillary buildings:* as our Temple Observatory, built, with house for curator, by subscription, at a cost of £1245; presented with a very fine telescope, the gift of the Rev. J. M. Wilson; and in charge of an Honorary Curator and resident Assistant; so as to be of use to our boys every clear night during each Term. A few of the boys every year become fairly skilled observers before they leave the School.

The Arnold Library at Rugby was built nearly forty years ago as part of a memorial to Dr. Arnold; and when, about five years ago, the Art Museum and Temple Reading Room were opened, the whole floor-space, and much of the wall-space of the Arnold Library (a lofty room, 75 feet × 25 feet) was devoted exclusively to the purposes of a natural history museum: not unfitly, for Dr. Arnold was the first to urge Rugby boys, now more than fifty years ago, to collect for themselves specimens of the geology, the flora, the fauna, of the district. I append a list of the more important objects in our museum, Appendix B (p. 554).

An Art Museum is a matter on which school experience is much more limited; and, except Rugby, I do not know of any English public school that possesses an Art Museum.

The idea of an Art Museum at Rugby School was received with much laughter at first. We were told we should not get funds to build one; nor wherewithal to equip one if built; nor boys to enter it if built and equipped. We did, however, raise the funds, £9000, needed to build the Art Museum and Temple Reading Room, with curator's house, opened in 1879; we have been given objects to help to start it, worth about £4000; and we have, by a charge of 10*s.* 6*d.* a year on every master and on every boy who has voluntarily used the museum, bought during the last five years about £1000 worth of carefully selected objects. I name in Appendix C (p. 555) the chief objects we have

been given, or have bought; and I mention these facts as themselves an encouragement to any school to build an Art Museum.

But no Art Museum will do much for boys unless there is personal guidance, personal enthusiasm, at hand; and besides the intermittent care of headmaster and his colleagues, a resident curator is needed not merely to register and arrange acquisitions, write to lenders, and do executive work, but also to show boys and other visitors the typical objects, the characteristic features, and so teach them to observe and think, to individualize and generalize.

Besides this, it is most desirable to secure good lectures from time to time on Art subjects. The lectures should sometimes be given in a large school-room, with copious illustrations on a large scale: sometimes they should be less formal, given to a smaller audience in the Art Museum itself, with illustrations on the spot: sometimes mere chats, on a group of subjects before you: sometimes a walk round the room with half-a-dozen or a dozen boys, pointing out the individual characteristics of bronzes, photographs, coins, statues, drawings, paintings, on the walls or in the cases at the moment. Appendix D (p. 556) contains the names of the chief lecturers who have helped our Art-work.

Besides gifts and purchases, a School Art Museum must rely largely on loans; for it is absolutely necessary to have a constant change of the objects on view; and while I acknowledge most gratefully the help we have received in past years from the South Kensington Museum, I must express very deep regret that this year we have been officially informed that our museum is not one that the authorities in charge of the Science and Art Department at South Kensington can assist. I should have thought the ungrudging sympathy and aid that we were given by Sir Philip Cunliffe Owen, Mr. Soden Smith, Mr. Poynter, Mr. George Wallis, in our earliest years, was not only kind but right. I should have thought the beautiful loan collections at the disposal of the South Kensington authorities, were never placed in a more appreciative centre of Science

and Art than ours; and I still hope that a wiser and more generous policy towards schools that with very great effort, and at absolutely no cost to the nation, have secured an Art Museum at all, may be adopted by those whose power to advance Art Education is enormous, and who certainly have the interests of Art at heart. Appendix E (p. 557) contains the names of our principal lenders and loans.

An Art Museum is of direct use as subsidiary to school teaching in several ways. It supplies the drawing master with excellent examples, in both form and colour. It supplies the classical and historical teacher with the original of many a simile in the old poets; with the photograph of many a classical site, temple, or ruin; with the portrait, on coin or medallion, if not in life-size bust, of many an emperor, king, reigning favourite, general, or statesman; with the emblem of scores of cities in Italy, Greece, Asia Minor, and the Isles of the Ægean; with whole scenes from the civic or religious life of Greece, as in the reproduction of the Pan-athenaic Procession from the Elgin marbles; and to the student of the Middle Ages, or the Renaissance, is of more obvious value still.

Indirectly, an Art Museum is a great instrument for refining and elevating taste; and since we have had an Art Museum here, a totally different, and vastly better, style of decoration, has been adopted by the boys in their private rooms, called studies here.

An Art Museum enables boys from every class of home to acquire a perfectly new sense, an eye for form and colour; to recognise the distinctive points in the style of different countries, of different schools and epochs in the same country, of different artists of the same school and epoch; to know a good work of art, in colour, stone, bronze, marble, ivory, wood, from a bad work; to know an original from a copy; to enjoy private and public collections in England, and desire to form a collection of their own; and makes a tour on the Continent, when at last it comes, a real enjoyment, and an actual education.

APPENDIX A.

THE WORK OF RUGBY SCHOOL NATURAL HISTORY SOCIETY DURING 1883.

BY L. CUMMING, M.A.

(To whom I am also indebted for help in the remarks on a Science Museum.—T. W. J-B.)

The work of the Natural History Society may be described under five heads, and following is a *résumé* of the work done in 1883 under each:—

1. Meetings are held about once a fortnight during the winter terms, and occasionally during the summer terms; at these papers are read and discussed and exhibitions made.

During the year we had twelve meetings, at which the attendance ranged from seventy-seven to forty. The chief papers read were on Electricity: The Uppingham School Aviary: The Human Skeleton: British Fortresses: The Colours of Flowers: Observation: The Breathing Apparatus in Insects: Spain: Edible Nests: Belemnites: Teeth: British Birds: Crystals: Beetles: Pike and Perch: The Land's End District: the Migration of Birds; most of the papers being illustrated by specimens, drawings or photographs in the magic lantern.

2. The forming and maintaining Natural History Museum and Library. The chief work of the year was forming and starting the aviary, suggested by Mr. Haslam's paper on that at Uppingham; the collection and arrangement of the type series of mammalian skulls; naming and arranging a large collection of South African shells; besides the general overhauling of all the collections, and incorporating additions made to them.

3. Excursions are organised during the summer term. Of these there were four last year, others being prevented by the wet weather in July. The first was to the gardens and woods at Coton House; two were to Uppingham, with different parties of members, on the invitation of Dr. Thring and Mr. Haslam, to see the aviary, &c., there; the fourth was to Wakerly Wood, where they were met by the members of the Uppingham Society.

4. Recording observations in Meteorology in connection with the Meteorological Society, and observations on the appearances of plants, insects, &c., all of which were carried on with more or less zeal by the various sections.

5. The Temple Observatory has always been regarded as a department of the Society; and there a great amount of work, specially Double Star observation, is done by the Hon. Curator and his assistant; and a certain amount of work is constantly done by the boys.

APPENDIX B.

CHIEF CONTENTS OF THE NATURAL HISTORY MUSEUM IN THE ARNOLD LIBRARY AT RUGBY.

1. Small aviary.

2. Model of neighbourhood of Rugby, 16 square miles: with actual survey of heights, by aneroid barometer, by masters and boys.

3. Fernery, vivarium, aquarium.

4. Typical series of crystals.

5. Typical series of minerals and rocks, arranged according to their chemical composition.

6. Typical series of anatomical preparations of the animal kingdom: Oxford issue.

7. Typical series of skulls of all orders of mammalia.

8. Physiological diagrams, animal and vegetable.

9. Small archæological collection.

10. Typical fossil collection of all geological systems.

11. Local fossil collection; started by Dr. Arnold, himself collecting. Still in process of formation. One find, Ophiolepis Damesii, by H. I. Elsee, 1877, then a boy in the school, unique in the lias formation.

12. Small collections in cabinets: plants, butterflies and moths, beetles, shells, birds' eggs, &c. Local specimens in each collection, specially noted.

APPENDIX C.

CHIEF GIFTS TO THE RUGBY SCHOOL ART MUSEUM.

By T. M. LINDSAY.

Casts of the Ghiberti Gates, originals in bronze at the Baptistery, Florence.

Original models by Flaxman.

6 casts of large statues; 14 bronze reproductions after the antique, full size and reduced, by Barbedienne, Amodio, &c.

Fac-simile reproduction of the Bayeux Tapestry on linen.

147 examples of pottery and glass, Greek, Etruscan, Roman, &c.

Several oil paintings, and many water colour drawings, by Turner, David Cox, Prout, Copley Fielding, Burgess, &c.

Over 100 original drawings in chalk, pen and ink, bistre, &c.; by old masters, including examples by Michel Angelo, Raphael, &c.

Original drawings by modern masters: Turner (1), Flaxman (2), Sir Frederick Leighton, P.R.A. (3), R. J. Poynter, R.A. (1), &c.

Number of valuable line engravings, etchings, and mezzotints, by, and after Turner, &c., &c.

Whole of the Arundel Society's publications.

Sets of coins, originals; also electro reproductions from seven centuries of selected coins in the British Museum.

Series of casts of gems.

Illustrated Art Library, including works illustrated by Piranesi, Hogarth, Flaxman, David Roberts, Owen Jones, &c.

Photographs, autotypes, lithographs, and other forms of art reproduction, illustrating the various phases of fine and decorative art.

CHIEF PURCHASES FOR THE ART MUSEUM.

Original oil paintings by Turner, Nasmyth, &c.

Original water-colour drawings, by David Cox, Samuel Prout, F. Danby, Copley Fielding, H. B. Willis, &c. &c.

Several copies in oil, by G. Moderati, sub-curator of the

Brera, Milan, of important Italian pictures. Bronzes, and Bronze reproductions from choice antiques, by Amodio, &c.

Entire set of fictile ivories, published by the Arundel Society.

Mezzotints, by Cousins and others, after Sir Joshua Reynolds, Turner, &c.

Several series of large photographs, autotypes, lithographs, &c., illustrating the galleries of Rome, Florence, Naples, Milan, Vienna, Paris, and the British Museum; as well as architectural and landscape views in Italy, Germany, France, Turkey, Spain, Switzerland and England.

APPENDIX D.

PRINCIPAL LECTURERS, AND SUBJECTS OF LECTURE, OR CHAT, ON ART, 1879—1884.

By T. M. LINDSAY.

Barclay V. Head, Esq. (2) (British Museum), Greek Coins.

R. Stuart Poole, Esq. (4) (British Museum), Greek Coins and Greek Art.

The Rev. Robert Burn (3 lectures), Roman Architectural Art.

Percy Gardner, Esq. (4 lectures), Greek Costume.

Dr. Charles Waldstein (8 lectures), Greek Sculpture.

T. M. Lindsay, Esq. (4) Wood and Metal Engraving. (2) History of Water Colour Painting, &c., (2) Ornamental Art.

The Masters of Rugby School, Chats on Art Architecture and Travel.

The Headmaster, on the Art and Architecture of Italy, Spain and Constantinople.

H. Lee Warner, Esq., the Acropolis of Athens.

Rev. C. B. Hutchinson, the Galleries of Spain and the Ghiberti Gates.

Rev. T. N. Hutchinson, the Development of Gothic Architecture.

Rev. T. D. Morice, the Excavations of the Forum.

W. G. Michell, Esq., Recent Discoveries in Rome.

The Curator of the Art Museum has also given a series of Chats or Clinical Lectures on Drawings by Old Masters (1), the

Technique of Oil Painting (2), the Technique of Water-colour Painting (2), Miniature Metal Work (3), Enamelling (2), on Colour Printing (2), &c.

The Headmaster and the Curator have gone round the Art Museum frequently with boys of Rugby School and other schools, and other visitors.

APPENDIX E.

PRINCIPAL LENDERS AND LOANS TO THE ART MUSEUM.

By T. M. Lindsay.

Christ Church College, Oxford, pictures, drawings, college plate.

Queen's College Collection, Oxford, historical portraits and college plate.

Earl Spencer, paintings by Titian, Paul Veronese, Murillo, &c.

Earl of Warwick, paintings by Titian, Dosso Dossi, Luini, &c.

The late Earl of Craven, oil paintings by Rubens, Jansen, &c.

Lord Ribblesdale, family portraits by Sir Joshua Reynolds, &c.

Lord Braye, family and historical portraits by Holbein, &c.

The Misses Bridgman-Simpson, Bilton Hall, family portraits, series by Van Dyck, &c.

Right Hon. J. Chamberlain, M.P., a collection of water-colour drawings.

David Bromilow, Esq., Bitteswell Hall, oil paintings of the Italian, Dutch and English schools.

Henry Chance, Esq., Sherborne House, Warwick, collection of modern water colours.

Messrs. Agnew and Sons, and also W. Agnew, Esq., M.P., collections of oil paintings and water-colour drawings, including examples by eminent foreign artists.

T. Woolner, Esq., R.A., paintings by English masters, J. C. Cotman, Bonington, Turner, &c.

R. H. Soden Smith, Esq., M.A., South Kensington Museum,

number of objects 80, in gold and silver, water-colour drawings, &c.

Matthew H. Bloxam, Esq., O.R., V.P., R.A.I., oil and water-colour paintings, ancient and modern, objects of ornamental art.

Rev. T. N. Hutchinson, original drawings.

The proprietors of the "Graphic" newspaper, complete series of materials and apparatus employed in the art of wood engraving as well as choice woodcuts.

Rev. T. W. Jex-Blake, D.D., oil and water-colour paintings, including works by Turner, Cotman, D. Cox, E. J. Poynter, &c.

South Kensington Museum, on three occasions, modern oil paintings, English and continental; framed examples, illustrating wood and metal engraving; splendid cases of original works, and electro-type reproductions, illustrating various art industries, viz., musical instruments, bronzes, enamels, gold and silver work, watches, &c.

Various manufacturers, examples of British art industries, chromo-lithography, glass and marble mosaics, wood engraving, &c.

SUBSIDIARY AIDS TO SCHOOL INSTRUCTION, CABINET OF OBJECTS, AND EXCURSIONS.

By J. H. Cowham, F.G.S.,

Westminster Training College.

The acquisition of knowledge by means of a careful observation of objects as they are collected and arranged in a school cabinet, or as they may be sought during an excursion in the field, is both an attractive and effective mental exercise. The school boy who is called upon to examine a specimen in botany or geology, or to perform an experiment in chemistry or physics, immediately concentrates all his thought upon the effort. He plies his teacher with questions, and is at once in the best possible state for receiving and retaining knowledge.

The educational value of the objective teaching which

a carefully-selected and well-arranged museum enables a teacher to give is so great, and extends to so many particulars, that its advantages would bear a more detailed statement than I have time to make. I may, however, summarise them by saying that this objective teaching—

(1) Supplies the pupil with precise information with the least expenditure of time and trouble to himself.

(2) Fixes the attention, while at the same time it developes and strengthens it.

(3) It yields training in careful observation, thus supplying the pupil with definite and reliable mental images.

(4) The verbal description of the facts observed affords a valuable exercise in the use of exact language.

(5) Lastly, the habits of observation and reflection thus acquired are subsequently available for more scientific forms of research.

The advantages of possessing a classified set of objects for school instruction being so great and obvious, I now proceed to indicate a mode by which they may be obtained. In fulfilling this part of my duty I shall limit my statements to the plan followed for obtaining objects suited to one branch of school work.

In the study of geography I have noticed that scholars find the accounts of the industries of a country, the commerce, and the lists of imports and exports, most irksome to learn. These fail to arouse interest, and hence are difficult to remember. Now, if the learner were taken over a mill, or through a factory, and there saw the material passing through its various stages of manufacture—the raw material, the sources from which it is obtained, the process of manufacture, the people engaged, the towns where they live, the finished article, and its market—all these would be noted with an awakened interest, which would render the ideas and impressions received both accurate and permanent.

In some cases children may be taken over a factory, or

through an Exhibition, in which manufacturing processes are in operation. Where, however, such visits as these are impracticable, the teacher may place in his cabinet of objects the materials which sufficiently indicate the gradual change from the raw to the finished article.

Here on the table is a series of objects, collected for the purpose of illustrating, as far as necessary, the various stages of manufacture in connection with the chief British industries.

In explanation of a few of the most important collections, I may make the following statement:—

1. We examine the collection of earthenware in the presence of a class of children. Their attention is first directed to the simple flint pebble—a part of the raw material which is obtained from the coast of South Devon. The stone is taken to Burslem, where it passes through the calcined and crushed stages to the slop state, as found in this bottle. Here, again, is granite in its rotten stage, as found in the basin of the Fal, in Cornwall. From this is obtained the kaolin, or China clay, now to be mixed with the flint slop. The class is slowly conducted over the remaining stages of manufacture—through the plastic clay to the thrown, the biscuit, the printed and glazed states to the baked and finished article.

In the foregoing sketch, it will be noted that a careful selection of the essential stages has been made, and these only submitted at first for inspection. Afterwards, the remaining details were added, at short intervals. Thus, a more complete knowledge of each process is secured, and a continuity of interest maintained. The same general principles should guide us in every separate instance, and the application of these will be carefully borne in mind in subsequent illustrations.

2. The collection of objects, representing the various stages in the manufacture of cotton goods, can easily be obtained, with the exception of the raw material in the pod. There is no market for this in England, and its supply depends upon the inclusion of stray pods in the bales of raw cotton.

I have purposely omitted from the cotton display the ordinary thread, and the various forms of plain and printed calico, for the sufficient reason that these are well known, and their addition, whilst it would not increase the knowledge of the observer, might divert the attention from those objects which the collector wishes especially to bring under review.

3. The production of raw silk may be made most interesting by allowing children to watch, from time to time, the various transformations the silkworm undergoes from egg to cocoon. A collection of silk stages may not be so necessary as those of cotton and wool, if we take into account the relative values of these British industries. The extreme beauty and delicacy of each of the silk products, however, make the collection of value as a contrast to the coarser products of cotton and wool, and they may also be made instrumental in awakening interest in other things similarly delicate and beautiful.

It is not necessary that I should enter into a detailed account of the various collections needed to complete a review of the chief British industries. It will be sufficient simply to enumerate them. To those already mentioned, the following may be added :—Woollen goods, leather, paper, straw plaiting. English woods, veneer and veneering. Sugar refining. IRON—smelting, steel rails and wrought—knife and fork, pen, pin, and needle. COAL, with gas products : Graphite, with the stages in the manufacture of a lead pencil ; jet and brooch-making ; petroleum and candle-making ; soap ; salt from brine to table salt ; the common ores, and the most useful building stones.

Closely related to the manufacturing industries are the imports and exports of a country. These in text-books are tedious lists, intended to be learned by heart. Here, again, the power of retention is aided by associating samples of the objects imported or exported, with the names of the localities from whence they are obtained. In illustration of this I have taken the twenty most valuable English imports. Each of the first eight is placed in

an illuminated circle, which graphically represents the relative money value of the import. Under the circle the learner reads the names of the countries supplying the article. The remaining twenty-two are also indicated in sample and by name, with the locality from whence obtained. These are intended for reference only, whilst the first eight, with their values and countries to which they are related, are intended to be particularly noted and remembered.

I may here remark that an exhaustive collection of material for illustrating either manufacturing processes or objects of commerce dependent upon them is by no means necessary. If in either direction we attempt too much, vague impressions are made, and confusion ensues. On the other hand, by limiting the display to the most important industries, with only the essential features in each, and by placing in bold relief the articles of highest commercial value, we secure impressions at once bold and striking.

The educational value of this collection of objects may now be briefly recapitulated :—

(1) The senses are trained by a close and well-directed examination of each series of objects.

(2) The collections are of sufficient novelty to arouse the attention and to secure vivid mental impressions. These will afterwards be readily recalled, and will form reliable material for further mental operations.

(3) The gradual evolution of a definite product here exhibited in its progressive stages, culminating in each case in a finished result, can scarcely fail to direct the attention of the pupils to the finer and more subtle gradations in the works of nature, by which the most complex are ever being produced by the combination and integration of simple elements.

The last consideration leads me to pass from the transformations effected by human agency to those which are constantly taking place in the works of nature around us. Here, however, the phenomena are often dependent upon

operations which occur on too vast a scale, either of time or space, for the child to observe them, as, for example, the movements of the planetary bodies, or the relationship between a range of mountains and its river systems. The need of apparatus is manifest in the first case, a well-directed field excursion will be necessary in the latter. The apparatus at present available for assisting the learner to realise these grand movements in nature are very complicated and expensive. That which can be made by the teacher himself is best adapted to the purposes of instruction. Apparatus thus prepared is of great interest both to the teacher and his class; moreover, it will be made for special ends, and all considerations not conducive to those ends will be carefully excluded. As an illustration of my meaning, I may call attention to a set of apparatus specially designed to assist children to understand such subjects as the relative positions and sizes of the planetary bodies, day and night, the seasons, phases of the moon, and eclipses. It will be found that any teacher, with the aid of an ordinary mechanic, may produce similar apparatus, and at a small cost, and that each of the appliances, whilst it provides adequately for instruction on the subject which it illustrates, avoids the introduction of complicated details.

Along with this inspection of the series of apparatus the scholar should be encouraged to sketch on paper flat representations of what he sees. This would form an admirable introduction to the use of the astronomical diagrams found in text-books. Thus used, the apparatus forms a valuable intermediary between the actual phenomenon as it appears in nature and its representation in a diagram. It serves the purpose that the sand or plaster model of a district does to its representation by means of a map.

This brings me for a moment to consider the raised models used in teaching the chief features of Physical and Descriptive Geography. For class teaching the large sand model is very effective. The time taken in preparing the model on a large scale is an objection frequently urged against it. If, however, the outline of the coast and chief

rivers be first chalked out on the sheet, then, by the aid of a narrow and long-funnelled water-can, the sand may easily be directed along these lines. The main mass of land area is readily covered with the sand. For representing lines of greatest elevation a few plaster casts may be prepared for permanent use.

This set of objects completes the appliances which for some years past have been in constant use by successive races of student teachers in this country, and, so far, they dispose of the charge which has sometimes been made by admirers of foreign schools who are unacquainted with those of their own country, to the effect that geographical facts are almost universally communicated to English children without the assistance of apparatus.

We have now seen the educational advantages arising from an examination of natural objects as they may be collected and arranged in a school museum. We have further recognised the necessity for apparatus of a simple yet effective kind to assist the learner in his efforts to understand phenomena which occur in nature on too grand a scale for successful direct observation. There are, however, some classes of natural phenomena which admit of being studied first hand in the field, and with greatly increased interest to those who can be introduced to them. I refer to such subjects as Botany, Geology, and Natural History generally.

In briefly sketching a plan for conducting excursions for educational purposes, I shall limit my statements to one of these branches of enquiry, viz., Geology.

In arranging a Geological Excursion for an elementary class the district selected should satisfy the following conditions :—

(1) There should be a considerable variety of rock formation.

An elementary class, for example, will appreciate an inspection of a series of distinct formations as seen in the cretaceous system, more fully than they could a minute examination of one formation only.

(2) At the same time care should be taken that each formation is sufficiently distinct to be striking.

In the example quoted above, whilst there are several members of the series, each form of rock can be readily recognised.

(3) The locality selected should afford facilities for the close examination of each formation.

These in geology consist of quarries, cuttings, borings, &c. As an example of a district which fulfils all these conditions, the road from Caterham to a little beyond Godstone, in Surrey, may be mentioned. Within a distance of less than four miles almost the entire cretaceous series may be examined, each formation bearing very distinct rock characteristics, whilst four quarries, a cutting, a boring, and a brick-field afford sufficient opportunity for close inspection.

Besides a careful selection of the ground to be traversed, full preparation of the pupils must precede the visit. In geology this preparation would include—

(1) Drawing a map of the district. This should be coloured to indicate the position of each formation.
(2) Sectional diagrams to show the arrangement of the different strata upon and beneath the surface.
(3) An oral lesson by the director, in which the entire field should be reviewed so far as, by the aid of maps, and diagrams, and oral explanation, this can be done in the lecture-room.

MS. notes of this lesson, illustrated by maps and sections, should be placed in the hands of each pupil on the morning of the excursion.

After the selection of a suitable district, and the full preparation of the class, the excursionists enter upon their inquiry under the best possible conditions for successful research. In the field the chief duty of the guide is to keep the attention of his class fixed upon the objects of pursuit. Here, again, as in the collection of objects in a school cabinet, if the attention is spread over too vast a

field no distinct impressions will remain. The well-wooded park, the prettily-situated village, the cultivated field, the luxuriance of wild flower and fern—all these, whilst they repose placidly on the sense, must not, in the present case be allowed actively to engross the mind.

Whilst special attention will thus be centred upon the objects which illustrate the previous teaching, the director will find opportunities for pointing out significant features which may have been omitted from his class-room lecture, and which, without his guidance, would escape the notice of an untrained observer, as, *e.g.*, the transition from the chalk surface to that of the gault in the excursion named above. Here no quarry is at hand to aid the pupil in his investigation, but the gault area is readily distinguished from that of the chalk by its flat weathering and its rush-covered surface.

An important feature in geological excursions might be the attempt to reproduce on the spot the surface appearance of districts similarly constructed, but which cannot be visited :—

> *E.g.*, the outward extension of the chalk area in numerous ridges over the south and south-east of England may be realised by an effort of constructive imagination, which, out of materials presented to direct observation at Caterham, elaborates a view of the whole series.

The collection of specimens, the naming of fossils, the use of instruments, and, lastly, the reproduction of the knowledge gained in the pupil's own words—all these form topics which I must be content to name.

In conclusion, let me summarise the various forms of object-teaching brought under review in this paper. These are :—

(1) Objects as they may be collected for individual inspection in school cabinets.

(2) Simple apparatus by use of which natural phenomena occurring on a grand scale may be explained.

(3) Lastly, excursions, by means of which the learner may be brought into actual contact with things as they arrange themselves in the field.

At the conclusion of the paper Mr. COWHAM, at the suggestion of the Chairman, gave a little further illustration of the mode in which the apparatus exhibited is used to teach the elementary parts of astronomy, such as the causes of eclipses, of the seasons, the phases of the moon, &c.

Mons. GROULT then read the following paper on Cantonal Museums in France which he had been instrumental in founding :—

A SHORT ACCOUNT OF THE ESTABLISHMENT OF CANTONAL MUSEUMS IN FRANCE.

By M. E. GROULT,

Founder of the Cantonal Museums.

THESE museums of a new kind are to be established in all our "chefs-lieux de Canton" (a canton, as you are aware, is an administrative division, 25 to 30 square miles in area) where the peasants come to make their sales and purchases. These Cantonal Museums are essentially democratic, and devoted to popular education. Their aim is to moralise through education, and to diffuse artistic and scientific notions; in order to obtain this result, explanatory notices are placed by the side of all the objects exhibited.

The Cantonal Museums fill a gap in French popular

education; and they should not be confounded with the School Museums.

I do not think it necessary to point out all the differences between these two kinds of museums. I have treated this subject in my 'Annuaires,' to which I must refer those who may be desirous of obtaining further information on the subject; let it be sufficient for me to say that the School Museums are destined for school-boys, whilst the Cantonal Museums are destined for adults; hence a wide difference in their organisation.

An example will explain what I mean:—A grain of wheat may be placed in a School Museum, as well as in a Cantonal Museum; but the explanations given with regard to this grain of wheat will be very different.

In the School Museum the natural and chemical composition of this grain of wheat will be explained to the children, also how the germ is produced, and how the root, stalk, and ear are formed. This is *pure science.*

These very interesting explanations are supposed to be known to the visitors of Cantonal Museums; what is to be explained to them is: the various kinds of wheat to be grown in the region they inhabit, the depth at which the seed must be sown, the nature of the soil, and the kind of manure to be employed. This is *applied science.*

It will thus be readily understood that the first aim of the Cantonal Museums is to promote the progress of agriculture.

The agricultural section of Cantonal Museums comprises the following divisions:—

1. Buildings.
2. Agricultural machines and implements.
3. Domestic animals.
4. Fruit trees, fodder, grains, and roots.
5. Manure, natural and artificial.
6. Drainage and irrigation.
7. Forestry.
8. Apiculture.

9. Pisciculture.
10. Agricultural maps and statistics.
11. Agricultural markets and general information.
12. A "Tableau d'honneur," or tablet for the inscription of the names of agriculturists who have obtained agricultural rewards during the year.

The other sections of a Cantonal Museum are the following:—

Industrial and commercial section.

Marine section (in cantons situated in the vicinity of the sea).

Health section.

Artistic section.

Scientific section.

Educational section.

There is no need to dwell on the organisation of the various sections, except to point out that the collections of the Cantonal Museums are essentially local, because their aim is to diffuse knowledge in one canton, and also because they are formed gratuitously and through donations only. As a matter of course there is no expense to be incurred in collecting a few plants, some stones and a few fossil remains to illustrate local botany, geology, and mineralogy, and so on for the other collections.

The principal contributors to the museums in each Canton are the scientists and men belonging to special professions who live in the region, and among them we may mention particularly the engineers, chemists, medical men, veterinary surgeons, notaries, justices of the peace, and, as a matter of course, the teachers and schoolmasters.

All these benevolent men meet together and form the *Société du Musée Cantonal et des autres œuvres cantonales patriotiques d'initiative privée.*

This is how, in my country, we understand intellectual decentralisation. We wish to make of every one of our small country cantons a centre of popular education, in

order to improve the condition of our peasants, and to accustom them better to love and cultivate the land they till at the sweat of their brow. Our aim is to enable them to enjoy all the advantages of science and of art.

DISCUSSION.

In reply to the Chairman, Mons. GROULT said that these Cantonal Museums were carried on at the expense of the Commune, and were open free to all the inhabitants. They might be considered as a further development of the School Museums, which were also encouraged in France.

Mr. HORSFALL said, for the last seven years he had given a good deal of thought and time to the forming of collections of works of art for elementary schools in Manchester and Salford, and one or two points had come before him which might be of some use to those persons who were desirous of taking part in similar work elsewhere. First of all, however, he would say one word on a portion of Dr. Jex Blake's paper, in which he expressed his regret that the authorities at South Kensington had refused to help the Museum at Rugby by the loan of a number of works of art. Now he was exceedingly glad to hear of the refusal, because he knew that throughout the country there were a great many places where there were large masses of population who had absolutely no one amongst them who was familiar with the importance of museums, and, therefore, were entirely deprived of the help of those who could take the initiative in the formation of museums. Such a district as he referred to certainly had the first claim on the help of South Kensington. It was much to be regretted that a school like Rugby, directly connected with the richest and most highly educated classes of England, should think they had any claim to help from the South Kensington Museum. Art could not flourish in any

country in which there was not a great deal of public spirit, and if the boys who went to public schools and their parents did not feel that they were equal to the task of providing such schools with the fullest collections they could need, it was no use taking any trouble in future to promote the cause of art. Passing from that subject, the importance of which had been brought before him by his familiarity with the destitute condition of the mass of the population in large manufacturing towns, especially the East end of London, he would come to the more useful part of what he wished to say. This Conference had been distinguished by the fact that in every department the necessity of educating by means of real things had been distinctly recognised to a degree which certainly surprised those who for years had had occasion to regret that mere empty words were so largely made use of in the work of education. This might indeed be called the Kindergarten year, because the value of the Kindergarten principle had been recognised in every department. In forming collections for schools—on the importance of which he would say nothing—it was exceedingly desirable to take for guidance the fact which Dr. Jex Blake mentioned that the Art Museum at Rugby had been found to have a most beneficial influence on the taste of the boys, as shown in the furnishing of their own rooms. In fitting up museums for any class those objects should be chosen which would have the most beneficial influence upon such branches of taste as could be exercised in ordinary home-life. In forming the collections in Manchester they had especially sought to provide the school museums with those kinds of pottery which were good in form and in colour, very often at the expense of mechanical finish. Because if you could interest a child in a good piece of pottery in a school collection, the child knew it could get a similar thing for its home; and if you could once introduce into such home one thing of which the beauty was recognised by the members of the family, that became a starting-point for the improvement of taste with regard to everything

used in the home. It was therefore to be regretted that more beautiful objects than those on the table had not been provided for the interesting museum at Westminster. Examples of the commonest French, Swiss, or Oriental pottery, many of which could now be obtained very cheaply, were far more useful in every respect, except for showing the sequence of the processes of manufacture, than those articles on the table, which were very mechanically formed, and were not beautiful enough either in form or colour, to give much pleasure. Similarly a great deal of good might be done by the right choice of colour for things used in museums. Some of the colours of the specimens of silk from the same museum were such as one hoped would be very little used in dress or in the furniture of a house ; it would be much better to choose those rich colours, which were now happily more plentiful, in preference to those very crude and glaring colours, of which no good use could possibly be made in any form of manufacture. He would point out to any one who wished to get things for a school museum, that nothing could be more useful than the beautiful photographs of flowers published by Mr. Hollier, which were to be seen in the collection of pictures exhibited by the Manchester Art Museum. They were intimately connected with the decoration used in various manufactures, and had a very good effect in directing attention to natural objects which children could find in the neighbourhood of large towns, and, therefore, would be a very desirable acquisition to any museum.

Mr. LANGLER said the question under discussion, namely the formation of School Museums, had no doubt very wide ramifications, and the examples of objects now on the table illustrated one particular branch. Mr. Cowham called it a branch of geography, and these examples were quite sufficient to illustrate a great principle. As Mr. Horsfall had just said there was an evident tendency in the discussions in all the Sections of the Conference to insist on teaching every subject by real objects. Now, from the beginning "real objects" had been presented to

every child and every adult throughout his existence; it was not real things merely that you wanted, you must have also an interpreter. These objects were on the table, but yet the Chairman had invited Mr. Cowham to explain them. Now, any one acquainted with astronomy or manufactures needed no explanation; but they were of course not all omniscient, and no doubt the information which had been given, brief as it was, would be helpful to any one present who might not understand these matters. 'Real objects' certainly should be put before children if possible, but it always required the intelligent teacher to make those objects of any real service.

> "A primrose on the river's brim
> A yellow primrose was to him;
> And it was nothing more."

The rustic saw the flowers and other surroundings, but he could not interpret any portion of nature around him without having intelligence. Only yesterday M. Couvreur told them that out of a series of twenty-seven questions put to the Belgian Army conscripts, one was as to the shape of the earth, and that only four per cent. of one series were able to tell that the earth was a sphere. But if even they *had* all known it was a sphere and could have answered the question accurately of what use would that be by itself? It was a mere fact; and that was the danger in education all through; the teaching of a number of facts and those facts put one upon another without an intelligent knowledge of their significance constituted what was called cramming. After some investigation of the matter he was impressed with the idea that all the attempts made to decry education in this country were utterly wrong, for he thought that under the new arrangements they were having as good an education in England as in any country in the world. Of course, if he went to Saxony, Mr. Mundella's favourite country, or Switzerland, or France, or America, he might find schools superior to some in this country, but on the other hand schools could be found here equal to those in any other land. Travellers, or official persons,

who went to those countries, were shown the best of everything, and came away with impressions not altogether incorrect, but partially so. He had received from the Bureau of Education in Washington, a report which commented in strong terms on the illiteracy of the United States. That country now contained children, almost all of them born in the country, of whom the illiteracy was something lamentable. However, what he wished chiefly to insist upon was the necessity of teaching from objects. As a member of the London School Board, the Chairman had shown great interest in this matter by trying to send to every school some apparatus by which instruction in objects might be given; but if you sent a box of test-tubes to an infant-school teacher what could she do with them? And if you sent other objects to other teachers what benefit could they be unless the use of them were known? A great advantage arising from the teaching of objects was the acquisition of a knowledge of language. Mons. Couvreur said that in Belgium the rustic population of seventeen and eighteen years of age which came to the conscription could not understand a sentence which was not spoken in the ordinary vernacular. These recruits had not intelligence enough to perceive the relation of the words; but that was not an experience confined to Belgium, it was universal; the red jackets who fought at Waterloo were not better informed than these modern Belgians. Instruction in reading, writing, and arithmetic was only one element which went to constitute character and to build up the force of the nation, and therefore to confine our attention simply or solely to these was a great mistake. One important error—blot, he was going to say—in our present educational Code was the keeping of little children's attention to mere literature; spelling and grammar being subjects of examination, and this (especially for children who left school at the Fourth Standard) was a serious error. If they stayed at school longer, there was nothing better to cultivate the mind than the nice discrimination between words. But what children wanted

was an extensive vocabulary as a vehicle of thought; and by the instruction in object lessons, an intelligent teacher could present words in their various uses, and that "want of intelligence" to which reference had just now been made would disappear. If they were to have, according to the new dictionary, 150,000 words in the language it was impossible for the mass of the people to learn them all; but the 10,000, or at any rate 4000 or 5000 words which were commonly used in ordinary society and in the press could by these object lessons be understood in their exact meaning. In one of the Sections someone pleasantly remarked that disputes or differences of opinion generally arose from want of discrimination in the exact meaning of words, and they very often terminated on mutual explanation. Was it not important then that little children—and he was speaking of young children who had to leave school as soon as they obtained a Labour Certificate—should have an extensive knowledge of words rather than of the grammatical distinctions between a few of them.

Mr. BALLANTINE, as a teacher of a very poor public elementary school, said he could say that the children had shown a very great interest in assisting to make a collection of objects very similar to those which Mr. Cowham had described. It was intended chiefly to illustrate the economic products of this and other countries. The scheme of object lessons, which was now dignified with the title of elementary science, consisted, in his school, of animal products in the first and second standard; vegetable in the third; and mineral in the fourth.. He did not know that he could throw any new light on the subject, but he wished to urge that there were museums where children could not possibly collect, containing objects which could not be brought before them at schools, and he wished the Government to offer inducements to teachers to take their children out to those museums. Unfortunately the children for whom this instruction was most needed were those which could least afford it. Then there was the grand Exhibition which should not be allowed

to close without every school in London and the neighbourhood having an opportunity of visiting it. Again they had great national advantages in picture galleries and museums, but children knew very little of their existence, and they grew up having no interest in them, and feeling no personal property, so to speak, as citizens of the country in those great collections of which a great deal more ought to be made. Furthermore, he thought it would be well if instructions were given to the inspectors that they might give permission that the children's visits to such places as the British Museum or the picture galleries, under proper supervision, might be considered as school attendances. That idea might perhaps be open to objection, but if properly carried out nothing but great national good could come of it. The greatest good of all would be that the children would feel an interest in the nation they belonged to, and would not grow up to be simply individuals with no interest in the political welfare of the country.

Mr. J. G. FITCH said he was glad to have the opportunity of saying what Mr. Ballantine could not have said for himself, that he was one of the ablest and most successful elementary schoolmasters he ever had the pleasure of seeing, and he was particularly struck with his success in forming a museum in his school. It was very largely the product of the children's own co-operation, for he set them all to work thinking and enquiring as to what was going on in their own homes and in their father's trades, and in that way they had an opportunity of adding a little to the resources of the school, and to the improvement of their fellow scholars. The moral effect of this in increasing the pride the children had in the school as an institution, and their sense of mutual help and their duty to one another, was not the least amongst the great advantages which that sort of effort yielded. He had been particularly struck also with Mr. Ballantine's observation as to the importance of occasional visits to any sources of instruction or interest in the neighbourhood, for those outdoor opportunities of improvement were too much

neglected. What Mr. Langler had said was also very striking, that it was no use being surrounded by objects of interest unless you had an interpreter. You did not find as a matter of fact that people who lived in the midst of the most beautiful scenery, which would gladden the heart of a Londoner, were any more refined because of their habitual surroundings. It was not the eye alone which saw; it was the instructed and educated eye; therefore the mere collection of a great number of interesting objects presented to children was not of itself an education unless there was someone at hand who knew how to use them. That was at present one of the defects in education; but it was no use to be impatient, for they must remember that the sense of the need of this objective teaching was only a rather late product in educational history. For years people had been taught all that could be taught from books, and the school-teachers of the last generation were mainly book teachers—teachers who did very honourable and good work so far as it could be done by school lessons and by literature. That system could not be revolutionised all at once. The power to make such objects as were exhibited on the table really effective as part of intellectual training, was still rather a rare power; there had not been enough attention given to it in Training Colleges, or meetings of teachers, or in any other ways; nor was there as yet a sufficiently instructed and qualified body of teachers to use it rightly. That was why he was so particularly gratified to think that one great result of the Conference, especially with reference to the evidence which came from Belgium, would be to impress upon all, not merely the necessity of objective teaching, but the necessity of a special kind of training in order to make the objective teaching effective.

Mr. HERBERT MILLER (Yale College) wished to say a few words because he came from a country which had but little history, and scarcely any of those monuments of past history by which they were able to interpret the present. Unfortunately he did not hear the first paper as he

had hoped, because he thought it perhaps might have turned on an aspect of the question in which he was specially interested, namely, the gathering together in school museums of illustrations, and the history of language. Latin and Greek had been for many years, and probably would be for many more the way by which the majority of the young minds who aspired to high education were led into a knowledge of language and history; because they were the most perfect of languages, and about them were grouped all those languages which were most interesting to us as members of the great Aryan and superior races of the world. Those languages had been taught in the past, and were being taught in the present chiefly from books; and his experience of the method of teaching—which no doubt could be confirmed by many others—was exceedingly unpleasant, because attention was particularly paid to the grammatical structure of the language. They had been taught more to discipline the mind, and attention had been given particularly to the grammatical and philological elements; they had not been taught as things which contained and should interpret to us the great thoughts of the world, which had borne so much on its history, and which ever would bear upon it. They could be made much more interesting, as he had seen in the course of the last year which he had spent on the Continent, inspecting various museums, and he hoped to show his own countrymen how largely helpful those museums might be made—museums where it would be impossible for even a school of high repute and pecuniary ability to collect; though perhaps it might collect the element of it by two or three means; first, by means of photographs which might present to the mind the great centres of the ancients, such as the Forum, the Parthenon, and show the public architecture of those countries, also the domestic implements, armour, and so forth; all of which might be used with advantage in helping to educate the mind through the eye, which learned more by a single glance than by the reading of many

words. It was quite true as had been stated already that the importance of a knowledge of real things had been an especial feature of the Conference, and also how important it was that they should rightly interpret them which meant a right knowledge of ideal things. He should have been very pleased to have heard a paper on the subject of the relativity of knowledge, and on the kind of knowledge most important for the young mind. Of course it must depend somewhat on the capacity of mind, but there was a sentence of Plato's constantly lingering in his mind which he thought would be well for every teacher to bear in mind also. It was to the effect that narrowness of reasoning should be most alien to the mind of him who had made it his life's pursuit to reach out after the infinite and the ever existing both human and divine. That narrowness of reasoning was very apt to plague them if any one were giving special instruction; he was apt to overexalt his own special branch whether it were a language or some branch of science, and to insist upon it that that special branch or department with which it was connected should be taught to the exclusion or neglect of others, thus failing to observe that due balance between the various departments of knowledge. Now both the real and the ideal were needed, the real to give a right and correct knowledge of things as they existed, and that, fortunately, at the present day, was largely within their reach. England by her great energy, by her grand sea daring, had brought to herself the riches of all nations which lay plentifully at her feet, and she could if she wished give a knowledge of them largely to her children, not only that they might desire material wealth and enjoy material comfort, but also by means of her great thinkers, her interpreters, her teachers, who also had brought her even more fame than those who had advanced her material prosperity, as by means of those men also, she might interpret unto her citizens what was the meaning of this material wealth, and that they should not be held up simply as an ideal to be enjoyed on account of the comfort and luxury associated with them,

but that they might use these things only as a means to higher knowledge. Of course the great question always came, What was the higher knowledge—what did these things mean? and many were the interpretations; but after all that was the question which was ever ringing in their ears, and to which more than any other they longed for an answer. Therefore that sentence of Plato should ever be in their minds, that they should not too much insist on ignoring other things or on the necessity of a single one without being well assured of the relative position of the branch of science or that language towards the general sum of all knowledge. When well assured of that they could teach it or study it, and then they would not forget that narrowness of reasoning should be most alien to their minds, and would be trying always to reach out towards that which seemed to him the object of all education, a general knowledge of the laws of life, and the adjustment of themselves to them, which was the object of all right living.

Mr. JAMES BAILEY said he thought all were agreed as to the great importance of the papers which had been read, and if he were at all disposed to be critical he might perhaps find fault in Mr. Cowham for calling these things subsidiary aids, for they seemed to him to be so important, that they might well be called primary aids to education. Pestolazzi in Germany, followed by his celebrated pupil, Frœbel, and David Stow in Britain, had shown the great importance of this principle of teaching, namely, the science of observation, guided by the intelligent aid of the teacher. If he could he would emphasise what had been said by Mr. Langler, that what was wanted at present was the second part of thorough teaching, which consisted in the right interpretation of that which was shown. No doubt many persons present had been sometimes amused, and perhaps distressed somewhat in seeing the way in which teachers made use occasionally of illustrations which were brought forward for the instruction of the children. A table was covered with a series of objects, and put before a class of little children, and the very first thing the teacher

would say was, "Now children I do not want you all to look at this," which, of course, was the very way to secure that which he did not want. It was quite necessary to bear in mind the caution which had been given not to diffuse attention too much, but rather to concentrate it, but at the same time there was an opposite error sometimes seen, that of not allowing little children to satisfy their curiosity at first by a general look at those things which were to be the means of illustration, and then, after having done that, directing their attention to special details. As to the necessity for illustration, and real as distinguished from mere verbal teaching, there was no doubt whatever. Mr. Horsfall had made a very valuable remark which yet bore a little hardly on the possibilities of many teachers getting together objects of illustration. He felt a certain amount of gratification that he could look on the tea-cup and saucer before them, to which exception had been taken, without any great sense of its want of beauty. Two things should be kept in mind with reference to objects to be placed before children; one, that there should be a training of the sense of beauty, and the other question was the utility, which was the primary object of these things, in showing the children how the process of manufacture was carried on. And with regard to the colours which had been objected to, as long as scarlet poppies flourished, so long as the delphinium, with its bright deep blue, gladdened one's eyes in the garden, and so long as the sun-flower, the great object of æsthetic admiration, flaunted its colours to the eye, so long would it be necessary to show pupils these colours, at the same time giving them what guidance you could in the more tasteful use of them. He would not say for a moment that he should like to see so brilliant a colour in certain places, but it had its uses. With all diffidence, he did not think a lady's bonnet was a precise place for it, but certainly little children were not likely to be very seriously injured by hanging those particular colours just before them. At the same time the cultivation of a refined taste was a matter the teacher

should not lose sight of. Mr. Cowham's paper was perhaps as valuable for what it suggested as for what it directly inculcated. Its suggestiveness lay in showing how, out of humble and moderate materials, the teacher might produce very satisfactory results, and this suggestiveness, too, might answer an objection which some, possibly, might take, and which he confessed was a little present to his own mind, that perhaps certain recommendations of Mr. Cowham would somewhat trouble teachers who were unable to adopt them. It was an admirable thing to take a class of children out for such geological investigations as he had referred to, but what were teachers to do in the midst of great towns and cities, who were quite unable to take their children out on such excursions? He thought they might do on a small scale, something like that which Mr. Cowham suggested. A large gravel playground, or any bare place in the neighbourhood of the school itself, would, under the guidance of this intelligent interpretation of the teacher, do a great deal to help the imagination to realise what the Sahara must be; so, again, hot summer weather might help children to understand something of the climate of tropical countries, whilst the phenomena of winter, with snow, hail, and ice, might help to convey an idea of the Arctic regions. The important principle was that the teacher should use what lay about him, in order to assist the children to a knowledge and understanding of that which lay at a distance either in time or space. At the same time, too much must not be attempted in the way of illustration. The eye might be dazzled by excess of light; and observation in the same way might be dimmed just as distinctly in the result, and as seriously as from want of light. One of the great lessons to be learnt from these discussions was not only the necessity for object lessons, but that the teachers must use them intelligently. There must be enthusiasm, and a love of teaching, a throwing of the whole life and character into it, together with the most careful observation and attention to those means by which they could carry out intelligently the true scientific principles of education.

Mr. Philip Magnus said he desired to add his testimony to the great importance of museums and cabinets of objects as aids to school instruction. Mr. Fitch had very wisely said that they were at present only in the infancy of objective teaching, and. as had been rightly remarked, hitherto teaching had been exclusively of a literary character, and probably for some time the greater part of teaching must still remain literary. In fact it would be exceedingly unadvisable for the literary element to be excluded altogether, though he did not think there was any great fear of that at present. Still it was important, as Mr. Langler had pointed out, that children should be taught language, the proper use of words, the meaning of words, and how to express themselves. Object lessons had been given for a very long time in schools, but not always successfully. He himself had seen schools in which it was customary to explain to children the nature of common objects without placing those objects before them, and of course a very few and simple questions soon elicited the fact that they had never had the things described in their hands. It was not necessary to say that object lessons of that kind were utterly useless. The question of object lessons was not without difficulty. Those who had taken most interest in education had given considerable attention to this question, and he was inclined to think that object lessons to be valuable should be properly organised so as to lead to some definite knowledge. Dr. Bain, in his excellent work on education, dwelt very fully on this matter; it was most important that teachers should have a distinct scheme in their minds with regard to the object lessons they gave so that each lesson might have some reference to the preceding lesson, and that the studies should really form a regular course of progressive instruction. Again, with regard to such instruction as might be given from the objects on the table, some care was required. It was very important no doubt to teach a child something of the various manufactures of the country, to show him the stages through which a pen must

pass from the sheet of metal until it reached the form in which he used it; or again to show him a sheep, and point out the various stages through which the wool must pass before it was woven into cloth. At the same time children were very ignorant beings, and gained very little idea of the process of manufacture from merely looking at such objects. The instruction would be much more useful if it were supplemented by photographs showing the machinery which had to be used in order that the wool might be made into yarn, and the yarn spun into a fabric, or, what would be still better, if the children could be taken to the factory so that they might have some real idea of the kind of machinery which had to be employed. Great care should be taken that object lessons should be real, not mere shams. Some years ago he was with a child about twelve years of age in Paris. He had learnt geography from books, but was perfectly surprised to find that Paris was on the same River Seine as was described in his geography. It was most important that children should realise the things they saw were the same as those they heard their teachers speak of, or which they learnt from their books. He attached very great importance to school museums, and in this respect the schools on the continent were far ahead of us. It had been said that those who visited the continent were always shown the best schools, and did not have the opportunity of seeing others. If so, they must see a very large number of best schools. He had visited a great number of schools in England, and had been struck over and over again with the nakedness of the walls, and with the absence of objects appealing to the senses of the pupils. He was happy to think, however, that of late years a great improvement had taken place in the elementary schools in this respect, on most of the walls of which were now to be found good maps, and many had some approach to a museum, whilst in others there were pictures appealing at once to the observing faculties of the children; in this respect the elementary were far in advance of the secondary schools. For this reason he was very much pleased with

the paper which had been read by the head master of Rugby, who seemed to have made a very laudable effort to obtain a good museum and collection of objects. He thought it was of the greatest possible importance in secondary schools that there should be cabinets of objects, collected, if possible, by the pupils themselves; and he was very glad attention had been drawn to the importance of this effort being made by the pupils. It was in the search after objects, and in comparing them with typical objects, that a great part of the educational value of such collections really consisted. In the secondary schools on the Continent cabinets of objects formed as much an instrument of instruction as in the primary schools; and he would invite visitors to the Exhibition to notice how much in advance foreigners were in this respect over ourselves. In fact, nearly all the objects now used for illustrating lessons had been originally made on the Continent, some beautiful specimens of which, exhibited in the French collection, he would call especial attention to.

Mr. MANSFORD (Westminster Training College) thought the attractiveness of the specimens shown in connection with Mr. Cowham's paper had somewhat diverted attention from another part of it, namely, the home made apparatus which was also exhibited. It had been laid down as a general principle that the objects in the museum should be collected by the children themselves, and it appeared to him that some principle should be applied to the construction of apparatus. Mr. Cowham and the teachers connected with him set their children to work on this, and a very interesting part of their work it was. When you collected an object for a museum, you required an interpreter; but when a child had made a piece of apparatus to illustrate a scientific principle or fact, the construction of the apparatus was the interpretation, and by encouraging him to make it himself under the direction of the teacher, the mind dwelt sufficiently long on the idea to take it in thoroughly and realise it; and if he succeeded in constructing the apparatus, his knowledge of the principle,

at all events, was complete. Nothing pleased him more in walking through the exhibition, than seeing the apparatus constructed by the children of the Birmingham Board Schools, and by some of their own schools, illustrating the laws of light, heat, and mechanics. It was true the apparatus was somewhat rough, but it was sufficient for the purpose, and if they could insure that it should be also beautiful, it would be an additional charm. In order to be useful it need not necessarily be ugly, and the child should be encouraged in making apparatus, even of the simplest kind, to make it as well as he could. If he could succeed in giving accuracy and finish to it, his satisfaction in it and the educational training he received from it would be all the more complete. He thought it must be admitted that English schools were open to the strictures which Mr. Magnus had passed upon them with regard to advance in the matter of museums, and it would be presumptuous on his part to add anything to what he had said. Any observer walking round the rooms of that institution could not fail to be struck with the fact that the foreign teachers and schools showed very much more complete museums than we could display. He would point out, however, that the teacher of an ordinary school would have great difficulty in getting at some of the materials required for such a museum. It had been said that he should in the first instance collect materials in his own neighbourhood, which was a sound principle to begin with, and they should be arranged on some scientific principle. As they had been reminded already a collection of object lessons did not constitute scientific training, and neither did a mere collection of objects constitute a museum. They must be arranged on some plan if they were to have any educational value. The mere classification of them was of itself a very good educational process in which the children should be encouraged to take a part. Then again, with regard to larger museums, he thought they must look to public bodies, committees, and school boards to provide them. In the French and Belgian Departments there was

a fine museum representing the imports and exports of particular towns, but where could they look for a museum representing, for instance, the imports and exports and industries of London or any other large town? He hoped it would be considered in future the function of School Boards to provide such museums. He thought it would be a very proper application of the funds of the School Board to provide such a central museum of which each teacher might perhaps have himself collected a small section. He also trusted that the remarks of Mr. Ballantine had fallen on willing ears, and that some of his suggestions would be carried out.

Mr. HUGH CLEMENTS said he was a manager of one of the largest schools in London; it was a new school, and there had been some difficulty in providing a museum. So far as he could he had assisted in lending specimens to both the boys' and girls' schools, but in regard to many of the objects on the table the head teachers did not exactly know where they could be obtained. That was one way in which the London School Board could assist teachers, by having all these objects such as were required in elementary education at the head centre, and issuing a statement showing where they could be obtained and the prices, if this were done many teachers would be willing to purchase these things themselves. If they depended on the children bringing specimens they got a most heterogeneous lot, many of which ought not to be there at all. He knew several head-teachers of Board Schools who had excellent museums, whilst others had very bad ones, and some had scarcely anything worthy of the name. Another point which he would impress on the London School Board was that they were lagging far behind Birmingham, Manchester, and Liverpool, who were making very great efforts to carry out technical instruction. In Birmingham a scientific instructor went from one school to another, and the children were taught to make elementary experiments in chemistry and electricity, and took a great deal of interest in it, and even made simple

pieces of apparatus. He should also be glad if the School Board could see its way to the introduction of graded schools into which the more advanced boys could be drafted. This would be of immense benefit to the children of the working classes of London, who, in this respect, were far behind those of most foreign countries. Only that morning, in the agricultural section, it had been noticed that there was a great deficiency in the technical education of labourers compared with what existed abroad. In Belgium, the children in that class of life were taught to make models of simple machinery, but in this country when a farmer got a new machine the labourers did not understand it, and very often he did not understand it himself. If technical instruction of this class were thoroughly carried out, England would in a few years take the lead as she had done before.

Mr. HEWITT (Liverpool) said an interesting experiment had recently been tried in Liverpool in connection with school museums. There were small museums or collections of objects in most of the schools, the greater part of the specimens being contributed by the children themselves. In some cases the specimens and museums as a whole were very admirable, whilst in others they were small and insignificant, and nearly useless. A gentleman who took a great interest in museums, the Chairman of the Museum Sub-Committee of the Corporation (Rev. H. H. Higgins), being much struck with this fact, had recently endeavoured to supply schools with specimens which should be really valuable, striking, and beautiful; and a number of sets of natural history specimens had been prepared which were lent out to the different schools for a month. They were then collected and a new set sent out. This experiment had only been in operation for about two months; but, so far as it had gone, it had been received with the greatest eagerness by the teachers and the children. Difficulties were of course met with in the matter of distribution and collection, but the curator of the public museum had applied himself actively to this part of the

work, and he thought now the arrangements were almost perfect. As yet the collections had not got very far; there were four or five collections of vertebrates, ten or twelve of invertebrates, and several of minerals, and he hoped, when it was completed, there would also be several sets of ethnological specimens. These specimens were so placed that they could be not merely put in front of the class, but in nearly every case the children could come and handle them, very little restrictions indeed being placed on their use. The object was to try and make a striking impression on the mind of the children by means of these specimens, and so lead them, if possible, to make inquiries as to the nature and use and characters of the specimens they saw. It was found that the museum in the centre of the town was not made so much use of as it might have been by the schools of the district; the teachers found some difficulty, especially in the matter of time, in getting the children to the museum. Of course they advised them to go during the holidays; but there was great difficulty in doing it during ordinary school hours. If the suggestion thrown out by Mr. Ballantine were adopted, and a visit to the museum could be reckoned as an ordinary school attendance, it would go far to remove that difficulty. It was in order to interest the children and parents that portions of the museum had been sent round to the schools in the way he described, and he believed in one or two cases already the interest awakened in the schools had had the effect of attracting the children in larger numbers to see the more complete collection in the central museum. This was to some extent carrying out the suggestion thrown out by Mr. Mansford as to what could be done by public bodies, and he hoped it would be largely followed in other places.

The CHAIRMAN (Dr. Gladstone) said Professor COSSIO had prepared a paper descriptive of a museum in Madrid, a translation of which would be read by Mr. Capper.

Mr. CAPPER said that, during his stay in Madrid, he had been very much struck by the advantages schools could derive from public museums. There was a large public school there, the Institucion Libre de Enseñanza, an account of which he read the other day. In this school Professor Cossio conducted a class on the History of Art, and amongst others he had the great advantage of attending this class last year. It was conducted during school hours in the magnificent picture gallery of Madrid. The boys were taken to the gallery, where, in presence of the pictures, lectures were delivered to them, and he could say from his own experience that the result was most admirable, for he had never before had the pleasure of attending so living a History of Art as was thus obtained. He wished that similar lectures could be delivered in the National Gallery in London, which would be immensely valuable from the mine of wealth there contained, the collection being remarkably complete historically. This was a step in advance which might be made with very great benefit.

SOME ACCOUNT OF THE EDUCATIONAL MUSEUM OF SPAIN.*

By Professor COSSIO,

Director of the Museum.

THE Madrid Educational Museum of Elementary Instruction (in Span., "Museo Pedagógico de Instruccion Primaria") is one of the latest creations of the Spanish Government (due especially to Sr. Albareda, the Minister, and Sr. Riaño,

* Translated and read by S. H. Capper, M.A

the Director of Public Instruction) for the advance of the movement of progress in education which, due in great part to private initiative, has assumed in recent years a very real importance in the country. As director of the museum, and delegate from Spain to this Congress, I venture to ask your indulgent attention to a few remarks on the way in which such an institution should be used as an aid to education.

The Madrid Museum is intended to render service rather for the education of school-teachers than of scholars; it is essentially *educational*, not *scholastic*. In view of the very grave difficulties that hamper the radical reform of the normal schools, above all, the severe want of a sufficient staff, the Museum's principal mission is to serve as the nucleus of the new organism which, without injuring or destroying, is to supplement and little by little fill up the chief gaps and gradually transform the old organism we already possess; for we have come to recognise in Spain the necessity of beginning all fruitful educational reform by thoroughly training the masters, seeing that *they* are presently to create the elementary and popular schools which are the basis of all culture, and where really the *nation*, not its wise men and specialists, but the great mass and backbone of the people, is to be formed. For this purpose, by the government decree of foundation and other regulations (of which I hope to have copies in French ready for distribution to such as take an interest in the matter), the officials of the Museum are permitted a very wide sphere of action; they have no real controlling power, but what I may call their *moral* authority over both the official and the private teaching world is capable of very wide influence indeed, their purpose being to disseminate information and tender suggestion and counsel, so that the various institutions of the country may more truly appreciate and administer the means of improvement and reform they possess. As, however, the life of the Museum in reality only dates from the beginning of this year (various delays having prevented the previous realization of the government decree of 1882), I cannot base this paper on what

has been done, but only on what we are beginning to do, and what ought in our opinion to be its further development.

The chief function of the Museum is to aid in the training of teachers, by putting before them in the most permanent and lively way, the state of our own schools and of those in other countries, the contrast between the two being of the utmost value in furthering immediate progress. It gives the normal school pupil and future schoolmaster an exact and most realistic knowledge of his country's schools, their various points of resemblance and divergence (a most important source of fruitful suggestion), as also of the result of individual efforts in the cause of progress; it cannot fail to be of the utmost use to them in demonstrating what lines they may most advantageously follow. On the other hand, it is an old saying that no one knows his own country till he has been abroad; not only for the purpose of learning and getting the benefit of the aims and aspirations of other nations in their education, but even to understand with certainty one's own, it is indispensable that teachers should be enabled to realize the condition of schools in other countries, the lines on which they have been developed, the stumbling-blocks they have encountered, the general laws thus demonstrated, and the special characteristics of individual cases. Moreover, such a museum forms a centre, through which the various individual and social efforts for the advance of education are not allowed to remain isolated or be lost altogether without serving as a basis for the work of other collaborators in reform; through it, similarly, the data afforded by the work of other countries for the solution of the same problems are rendered accessible. The disadvantage of this isolation is manifestly extreme, and can only be compared to the infancy of primitive civilisation, when each nation and age had to work out its own culture with vast effort, that remained lost to the rest of mankind.

Through the masters there is a twofold current of influence between the schools and the Museum. The schools

supply the Museum with the material, which the masters are thus enabled to work out and return, as it were, to the schools stamped with a new progress; and on the other hand, the Museum, if I may be allowed the figure, is the laboratory that sends out to the schools this material crystallized and refined for the work of education. The more elements there are for mutual comparison and criticism (especially if these elements carry with them the guarantee of reason and experience) the more certain can the schools be of the success of the new data which the Museum supplies to them.

The Museum is thus called upon to be the door for introducing into the country the various advances in elementary education made by other nations; and its constant aim should be anxiously to search out these, and not leave them to filter in at haphazard as the slow result of their own perhaps resisted, excellence. With this view, the Museum has to organise brief courses of weekly or fortnightly lectures on the points that experience proves to be defective in the programmes of (for example the normal) schools, or in the teaching of natural science, of art, &c.; obtaining, of course, as the guarantee of success, the assistance of the most practically competent persons, whether professional or not. To these lectures free admission will be naturally given to a certain number of masters, both those of Madrid and those commissioned by the municipalities and provinces, but above all to the pupils of the central normal school, who form the basis of the future teaching staff of the country. By organising competitive exhibitions of teaching apparatus, the Museum is bound to give the masters a living stimulus towards producing by themselves such materials of education as they may need in their schools, and to help in the less immediate future to the formation amongst them of a true artistic sense and manual skill.

Another of the objects of the Museum is to improve the schools. Of course everyone is aware that the best means of accomplishing this is to improve the masters, which implies at once that instruction will become from day to

day more complete, the relations between masters and pupils more rational, the school material richer, and even the school building itself be turned to better account under more truly hygienic principles. There is, however, a more direct service that the Museum may afford, and that is the lending of what I may call "circulating material." There are many things that even the best provided and endowed schools may lack, but which the Museum may possess and ought to lend from school to school—such as, for example, steam-engines, electric machines of high power, telephones, microscopes, phonographs, collections of anatomical preparations or plates of special value for the history of art, all of the utmost use for primary schools, but difficult to obtain or beyond the means at their disposal. The want of them may be due to negligence in the past, but in any case the money necessary for their purchase may be much better employed if the objects can be had on loan from a central museum.

A further direct benefit the Museum may confer upon schools is the influence it may bring to bear, by means of reports, circulars, information, and special advice, upon the centres or boards at present charged with the establishment and arrangement of schools, assisting them in the acquisition of material of instruction, by providing a channel of communication with the manufacturers. It should even aspire to the establishment of a workshop for the repair and improvement of the school material at present in use, offering the guarantee of competent educational knowledge and a rational judgment in lieu of the too often blind and capricious opinion of the mechanic (a total stranger to such questions), which is paid for at the sacrifice of the pupils, the master, the school, and the advance of education in the country. But we ought to be able to foresee the time when the educationalist alone, not the architect, the engineer, the doctor, or the mechanic shall lay down the rules and dictate the organization of our schools, on the ground that he alone is conversant with the essential requirements of instruction, and therefore alone capable of determining the means and special conditions of its produc-

tion; the time when the schoolmaster, who has the daily experience of ocular demonstration, and whose vocation it is to dedicate his life to such questions, should furnish the data for, if he does not actually fix the measurement of, such practical matters as the height and the distance of the benches, the orientation, capacity, and lighting of the class-rooms, the size of windows, and the relative merits of the various school furniture.

Such are the functions of the Museum in relation to the masters and the schools, but it must indirectly benefit even other spheres. For instance, in the decree of foundation it is mentioned that "it will encourage the manufacture in Spain of school apparatus and material, and it will confer no small benefit on the country if it succeed, as it has done in other countries, in creating a genuine industry of easy development and of vast and certain importance in the future." If indeed it is to be a living force, knowing how to press all possible means into the furtherance of its aims, it will open the way for the development of the entire industry relative to the manufacture of school furniture and material.

I will not detain you by an exposition of the contents and the plan of subdivision of the Museum. Suffice it to say that it should contain two principal groups, one comprising all that refers to the pupils, and the other embracing all that relates to the master himself and to the normal and educational institutions.

The means employed for the furtherance of these two groups is again of a double character, one comprising instruments, collections, special appliances for teaching, all in fact that serves *directly* for instruction; the other including school furniture, &c., *i.e.* all mere material for teaching purposes. The Museum will therefore have to be subdivided into two corresponding sections. The most natural classification of the first is under three heads: (*a*) means of specially physical education; (*b*) means of specially mental education; (*c*) means for the two in combination. The second section will contain (*a*) a part destined for the prac-

tical consideration of school sites and school buildings, with collections of plans and models of different establishments, both boarding and day schools, for girls, boys, and infants. Under this section should be data for the study of the various questions of interior arrangement, dimensions, orientation, the different systems of ventilation and warming, building materials, and architectural design. (*b*) School furniture, of which the most important is the school desk in its various systems.

As the functions the Museum is called upon to fulfil are purely educational or instructive, not administrative, its staff is naturally facultative, *i.e.* composed solely of educationalists. It is somewhat curious that this character should be frequently wanting in similar institutions, with the result that the directors become mere curators without any initiative, whose energy is intermittent or lost, as they cease to be a living centre of educational progress.

The department that comprises the collection of objects for the Museum implies much more than a mere knowledge by catalogue or even a personal acquaintance with manufacturing houses. It makes journeys of inspection and investigation a necessity, and they have been provided for in the decree of foundation as being the only way of getting at what is really *characteristic* in different systems.

The Museum must lend its aid to the exhibition of manufacturers' articles as a means of educational propaganda, publishing notes on the exhibits. In Madrid we intend to publish a journal for this purpose, as also with the object of obtaining by exchange a collection of the various educational periodicals published elsewhere, and we are very anxious to lose no time in putting ourselves in relation with foreign governments, in the hope that they will assist us by sending us their publications and, as far as possible, models or specimens of the school material they possess.

The Museum will also be enriched by the objects that have gained prizes in the competitions opened to masters. In the Ministry of Public Instruction ("Fomento") there

is a large collection of works relating to education, which is intended to be handed over to the Museum as the basis of its library.

The Museum should offer a genuine reflexion of the present condition of our own schools and of those of other countries, which is only to be gained by frequent visits and journeys, as provided in the decree; and this is a further reason for the necessity of having a complete staff of educationalists, lest a steady advance should be interrupted in the absence of the director. Moreover, the results obtained by the director's journeys will remain sterile if they be not disseminated throughout the entire teaching staff of the country, whence the need of constant reports and circulars to be distributed gratis to the teachers. It will be our constant effort to stimulate them to the development of new principles and methods by gaining their participation in less formal lectures and discussions on educational topics. For the purpose of facilitating healthy and useful intercourse and interchange of ideas amongst teachers, we hope to organize competitive exhibitions of their work in accordance with published programmes, more especially during the holidays.

The Central Museum will also endeavour to organize smaller local exhibitions, and even to arouse the interest of masters in the creation of local school-museums of every description, trusting to the visits of the Museum staff throughout the country as a great stimulus in this object. Moreover, in addition to the circulating educational library of the Central Museum, provided for in the government decree, it will aim at creating similar libraries on a smaller scale for local circulation in the provinces. As regards the material of the Museum destined for circulation among the schools, there are of necessity two classes: (1) Those objects whose transport offers no difficulty, and which can therefore circulate quite freely, with due restrictions as to the limit of detention in each school; and (2) those objects which either from their nature or from the defective conditions of the schools can only be used with advantage in the Museum

buildings. It will be the director's duty to acquaint the masters with all such apparatus, and to arrange for the reception of school excursions for the purpose of using or experimenting with them.

For one of the great aims of the Museum is to serve itself, in a sense, as a *school*, and it will be our constant effort to spread instruction by disseminating as wide a knowledge as possible of the objects in the Museum, their nature and use. We are arranging a systematic course of lessons, perhaps once a week, especially intended for the normal school pupils. In Berlin attendance on such lessons is obligatory for certain grades, and we hope that the attendance certificates to be granted by the director of the Museum will at least be taken account of by the Ministry of Public Instruction.

We hope to make our Museum catalogue a useful means of instruction, by making it more than a mere dry list of the names and nature of the objects; it should contain all essential details that will serve to give them a more living interest with a critical description whenever possible. By this means our catalogue will be a valuable aid in the cause of culture and educational propaganda.

The director is further charged to prepare an annual report which will comprise, besides a summary of the work of the Museum for the year, a succinct account of the course of educational progress during the year not only in Spain but abroad.

Such are the bases of this new educational institution, which I have ventured to place before this International Congress in the hope of enlisting your sympathy with our efforts for progress in Spain.

DISCUSSION.

The CHAIRMAN (Dr. Gladstone), in summing up the discussion, said it was quite true as had been remarked by one of the speakers that one of the most important results of the present Educational Exhibition would be the drawing so much attention to the subject of object lessons, and the museums, and to the great principle by teaching, by demonstration, by the actual exhibition of things as well as teaching by words. There had been a long battle raging amongst educationalists, whether they should study *res* or *verba*, but he was inclined to think it should be *res et verba*, but at the same time he thought they should be put in the order of *res* first, and *verba* afterwards. At any rate, it was quite certain that in the teaching of the very young things must come first, for they knew that all the first lessons of the nursery were certainly object lessons, and it was a great pity for the same system not to be carried on throughout the whole educational life of the children. For that reason he wished more had been said about little museums in infant schools. In the present instructions to Inspectors, it was stated that an infant school was not "excellent" unless it had a museum with various objects collected, principally by the children themselves, and it was hoped that with this instruction, knowing that the mark "excellent" covered an additional Government grant with it, these little collections would be found starting up everywhere over the country. It had been encouraged in the London School Board, and in reply to a remark of Mr. Langler he must say that the apparatus furnished to those who desired it for making simple experiments or objects was not given to teachers without a printed explanation of some considerable length as to the use to which every piece of apparatus had been applied. The collections in infant schools must of course be very miscellaneous; typical collections could scarcely be expected. The children were encouraged to bring

together things they had seen, and of course a good many useless things were brought, but that did not matter; they became eliminated in process of time, and it interested the children. They should be encouraged to bring in different sorts of feathers, leaves from trees, and so on; and then the comparison must be carried on very fully, which must lead to a large amount of mental training. When they came to boys' and girls' elementary schools, the museums ought to be of a somewhat better character, better organised, and of a more typical order. In France this had been carried out to a very large extent, and in Belgium, and in other places on the Continent. Even in England there were some very good specimens already, particularly the one spoken of by Mr. Ballantine, which he had heard was exceedingly good, and there must be others of equal excellence. In the exhibition-room No. 4, was a small school museum which would illustrate the kind of things which could be got together, and an inspection of which would answer some of the questions which had been put. There were some of the things there which would be above what should be ordinarily found in a museum, but the natural history collection belonging to Park Walk, Chelsea, and the geological one from a school at Peckham, were perhaps what might be fairly expected in a school museum. Again, there was one contributed by the Fox Museum, Silver Street, Kensington, such as was quite within the capability of any ordinary teacher to get together. The London School Board supplied the cabinet if there was a sufficient nucleus already made by a teacher, and of course, these collections might consist not only of what the children brought, but of such things as had been exhibited that morning showing the process of manufacture. The question had been asked how these things were to be got together. As far as the London School Board was concerned their desire was that it should be got together principally by the children, teachers, and managers; the objects could be requisitioned; they did exist in the London stores, and were requisitioned largely, but it would

be very wise to extend the system, especially in the direction of those easily obtained. He quite agreed with the gentleman who said they were much behindhand in this matter, but they must all know how difficult it was to get public bodies to move in a new direction. He was quite sure that this Conference and Exhibition would give an enormous impulse to education of that character, and he need only refer to the collections upstairs in the French and Belgium Departments to show how far in advance some of the continental countries were as compared with England; he would not say in advance of certain schools here, because he could point to schools which had admirable museums, but a visit to the room of the Fathers of the École Chrétienne would show a development in the way of technical education which was perfectly unknown here, except perhaps in some of the great collections made in training colleges. There had long been at the Home and Colonial Training College and at the Westminster Training College collections which might serve as models to the teachers who went out from those institutions. These collections ought to be more typical than many of them were at present, which would make them more educational, and he was glad to hear that this matter was carried out in such a princely style in Spain. He had also been much interested in hearing of what was being done in Liverpool, and should certainly endeavour to learn more about it with a view if possible of doing the same thing in London. Even in the Japanese Department there was a very good typical collection illustrating the different branches of natural history; with regard to the apparatus he need only refer again to the Birmingham and Wesleyan Society's collections which had already been spoken of. Then again, they had had brought before them an interesting account of the Communal Museums in France, which were a development of the same idea, and he hoped the same thing might be extended in other countries. If this became general, and if in addition they had such a large institution as the Pedagogic Museum at Madrid with all its

appliances, the matter would be tolerably complete. It was very important that this knowledge of nature should be brought home to every child in the community, not merely those in the elementary schools, but to the classes which were represented by Dr. Jex Blake, and he was glad to know that many of these public schools were forming such museums. It was of immense importance, especially to those growing up to be artizans, that they should be well acquainted with the world round about them, and had their senses expressed, so that they could perceive and judge of the material objects around them, and know something of the forces of nature. This instruction must be given not as isolated object lessons when it became hard and sterile, not merely as lessons given in the Museums, but it ought to run through every part of school teaching. The teacher might give an object lesson in two minutes on something which arose out of a reading lesson, by taking something out of the cabinet which illustrated it, and then go on with the more literary part of his work. This kind of thing ought to be infused in all the other lessons, and become part of the teacher's mind. They wanted things themselves in the schools, or that the children should be taken to see them, but besides that they wanted an interpreter of nature to make them capable of seeing what was presented before their eyes, and, therefore, the teachers themselves must have that intelligent knowledge which would enable them to make use of the materials at their disposal. He trusted that the attention which had been drawn to this subject would bring forth abundant proof, and that great impulse would be given to this kind of instruction, which was one of the most valuable kind which could be given in any school, whether elementary or those designed for the upper classes.

[The Section then adjourned.]

At the afternoon sitting Mr. PHILIP MAGNUS occupied the chair. He first read the main portions of the following paper by Professor Laurent:—

THRIFT IN SCHOOLS.

Épargne scolaire.

MY LORD PRESIDENT,

You have asked me to give a lecture on "Thrift in Schools" (*épargne scolaire*). As my health does not allow of my delivering it verbally, you have been good enough to authorize me to write it in the shape of a paper.

I.

1. You know, probably, my Lord, that it is I who have introduced the custom of saving money in the schools of Ghent.

2. The idea has—at least in appearance—met with prodigious success. It has been adopted all over Europe, and, I might say, all over the world, as it is being put into practice in America and in Oceania.

3. But I doubt very much whether it is true saving.

4. I mean "moral" saving—i.e., that which exercises moral influence on those who save money.

5. This is the kind of saving I have advocated in our gratuitous schools.

II.

1. Children possess nothing; and, as they do not work, earn nothing.

2. How can they save?

3. It is a general custom, among the working classes of Ghent, for the parents to give a few centimes on Sunday to their children as pocket money.

4. The children spend their centimes on bad fruit and coarse sweetmeats.

5. It is a twofold evil; they injure their health, and foster a failing which easily becomes a vice—viz., gluttony.

III.

1. I advised the children not to spend their Sunday centimes in a useless or injurious manner, but rather to save them.

2. The motive I gave them for not spending their money was, that the child who indulges in sweetmeats, after having eaten sufficiently at meals, is a glutton, and that gluttony is an ugly failing; and by taking the habit of spending their centimes on sweetmeats they keep up and foster their failings.

3. Saving will cure them of this defect, which alone is a great blessing. In order to save they must abstain from spending (that is, they must combat gluttony), which is a great blessing, and will accustom them to strive against greater failings, which will make them better every day.

4. Such are the arguments in favour of "moral" saving when addressing children.

IV.

1. When one has the assistance of schoolmistresses, or female teachers who are fond of children, one is bound to succeed.

2. To love children is enough to ensure being loved by them; and when the teacher is loved by the children, she can obtain anything from them.

3. I succeeded so well that, one day, the burgomaster told me that the number of sweetstuff shops was declining.

V.

1. Unfortunately the teachers, as a body, were not equal to their task. They did not understand "moral" saving.

2. The teachers, male and female, confined themselves to advise the children to save, and when, every week, the children brought a few centimes they were satisfied. They did not ask the children whence those centimes came.

3. The fact was that the children kept on spending their centimes on the Sunday, and, on the Monday, they brought to the school the centimes which their parents had given them.

4. The moral aim was entirely lost sight of.

VI.

1. Yet school savings seemed to prosper. The annual amount of savings was increasing because the parents were, as a matter of course, able to save much more than the children.

2. Statistics were prepared at the *Hôtel de Ville* (Town Hall) of these so-called school savings.

3. When it was known abroad that children were saving hundreds of thousands of francs at school, people were amazed, and all countries followed in our wake.

I am afraid that in all countries the savings are not true savings.

VII.

1. For a great many years this state of things continued at Ghent.

2. The official statistics were deceiving us in leading us to believe that the children were saving their Sunday centimes, that is, that they were discontinuing the practice of spending them uselessly.

3. It was nothing of the kind. The children were spending more than ever, for their artificial needs were constantly increasing. When five years old our little boys were satisfied with apples and pears; when eight years old they want cigars; and when they will be twelve they will want gin.

VIII.

1. You thus can see, My Lord President, how fatal the first habits of childhood are when allowed to take root and to become vices.

2. They must be combated by all possible means, if it is desired to moralize the coming generations.

3. I set to work again, advocating "moral" saving in our schools, and I succeeded even in the young children's schools, which we call "écoles gardiennes."

4. The results will be less brilliant than was supposed; we shall not save thousands of francs. But if, by the saving of centimes, we succeed in promoting morality, we shall have reached our aim.

IX.

1. My Lord, let me relate a fact which I witnessed.

A little girl, five years old, had promised her schoolmistress not to spend any more centimes on Sunday (1883). It was during summer. I entered the school after a holiday, and found the poor child weeping bitterly. I questioned her, and was told that the cause of her sorrow was that she had spent 20 centimes on cherries.

2. Those tears will not be useless: it was conscience that drew them; the child was won over to moral life. And we may hope that the whole of the rising generation will thus be moralized.

3. We are now preparing other statistics, and keep a record of the number of children who save all their Sunday centimes and do not spend any.

X.

1. To spend nothing in a useless or injurious manner in order to gratify artificial needs, such is true saving: that which I call "moral" saving, because it moralizes the rising generations in curing children and youths of their failings and vices.

XI.

1. I have advocated saving in the schools for adults, attended by young workmen and women, and striven to make them understand that saving is a duty, and a means of promoting morality.

2. Workmen consider saving from an economical standpoint only. It is, they say, "laying by for a rainy day;" it is a resource for old age, or sickness, or when work fails them.

3. Undoubtedly saving must improve the condition of the working classes. But that is the result, and not the aim of saving.

4. The first thing to be done is to give moral education to the young generations, and when that is accomplished, their economical situation will improve of itself.

XII.

1. Permit me, my Lord President, to quote the mighty words of Christ to those who are exclusively concerned with the material necessities of life.

2. "Therefore take no thought, saying, What shall we eat? or, What shall we drink? or, Wherewithal shall we be clothed? But seek ye first the kingdom of God, and his righteousness, and all these things shall be added unto you." At first one is inclined to look upon those words as Utopian or illusive.

3. Our proletarian classes, when they hear them quoted, say: Give us first bread, the staff of life, and then you can talk to us of the righteousness of God and his perfection."

4. It is commonly believed that the pitiful wails of the working classes are justified, and that the greatest evil from which they must be protected is poverty.

5. I say that the evil of evils is not hunger, but want of culture, and I mean the want of moral culture, or demoralization.

6. Why are the working classes always threatened with the pangs of hunger? Because they neither know nor fulfil the most natural and sweetest duties.

XIII.

1. I will relate to your lordship a conversation I had with three young workmen I met, who were taking their aged mother to the asylum.

2. "Why," I asked, "do you not remain with your mother? Or, if your gain is sufficient, why do you not have your mother to live with you?"

3. The three brothers did not seem to understand. They had no idea whatever, either of the duty of children towards their parents, or of the happiness to be enjoyed in the bosom of one's family.

4. Such is the want of moral culture among the proletarian classes.

5. I severely reproached them with their conduct.

6. "What!" said I, "you forget your mother's boundless love for you, her constant cares for your welfare, for your education; you owe to her the life of your body and of your soul. And in her old age you abandon her!"

7. "Our mother will be well taken care of at the asylum," said the eldest brother. "She will want nothing."

8. "What!" I replied, "she will want nothing! The happiness of seeing her children around her, of loving, and being loved by them, do you reckon all this as nothing?"

9. The youngest brother interrupted me, saying: "We also love our mother, and that is the reason why we take her to the asylum, where the nuns will attend to her better than we should be able to do."

10. "I know," I said, "that old people are well taken care of at the asylum; I have visited it. But I have seen also that notwithstanding the material comfort, their existence is deeply sad. They are among strangers, and do not know, and cannot have any feeling of affection for, one another.

11. "Old age has its physical, and particularly its moral,

sufferings. It has need of kind and soothing words to comfort it. Who will comfort your mother? Who will speak to her those kind and soothing words she was accustomed to listen to when in the bosom of her family? You say she will be happy in the asylum. How do you know, since you will not even see her? The surest means to know that she is happy would be to remain with her, and to contribute to her happiness by giving her abundant proofs of your affection for her."

XIV.

1. The three brothers were greatly surprised at my sermon.

2. "We do," they said, "what every one else does. Asylums are intended to receive old women. As to ourselves, we also mean to enjoy life. After working all the week, we have a right to enjoy ourselves on the Sunday, instead of remaining confined at home with our aged parents."

XV.

1. Such is the want of culture of the proletarian classes.

2. They have no notion whatever of the duties of man. They have a faint notion that their mother having loved them they also must love her.

3. But they do not know what it is to love; and when they have placed their mother in an asylum, where she will be housed, clothed and fed, they believe they have given her proofs of affection.

4. In truth they think only of themselves.

5. "We also mean to enjoy life." Such is their only thought. It is the grossest selfishness. What do they mean by "amusing themselves" on Sunday? Getting drunk, and ruining their soul and body, by the use of alcoholic drinks.

6. Whilst they spend their wages at the wine-shop, what becomes of their wives and children? They starve. That is the cause of the misery of the proletarian classes.

7. If you preach to them the necessity of saving, they meet you with the answer that they cannot save, and that the little they might put by would hardly be worth their while.

8. This is only an excuse for immorality; such is the real truth. I was one day lecturing on savings in a school for adults at the time of the Carnival. A working man replied to me: "After Carnival, M. Laurent." All of them save money in order to "amuse themselves" during that period, reserved for the coarse enjoyments of the wine-shop; and they save large sums, as much as forty and fifty francs. Enormous sums are spent during those fatal days.

9. There is another occasion for which working-men put money by, but always with a view to "amuse themselves;" it is the day when militiamen draw lots for the conscription. It is the universal custom that, on that day, each working-man must have in his pocket a sum of twenty francs at least, to be spent in drink. Some get intoxicated in order to forget their sorrow, and others to celebrate their luck. They can then be seen parading the streets, dead drunk, roaring and dancing like savages. This is called "*enjoying life* and amusing oneself." It is pretty nearly the same thing every Sunday in the innumerable wine-shops where working-men congregate.

XVI.

1. May I be allowed, my Lord President, after having pointed out to you the excesses caused by the want of culture of the proletarian classes, to return to the words of Christ I have quoted above, and to apply them to the misery of the needy.

2. I sympathise with their sufferings, and am trying to find a remedy for them.

3. The remedy has been pointed out, preached two thousand years ago by Him who came to save our souls. To the hungry he said, "Save your souls, and you will not feel the pangs of hunger."

4. I say to the proletarian classes: Be moral, seek the perfection of God your Father in Heaven. Make it your own, and when you are moral beings then you will no longer be proletarian beings.

5. Instead of thinking of one thing only, of amusing yourselves, of enjoying life, of drinking, you will constantly think of perfecting yourselves.

6. God has given you children, angels descended from heaven to remind you of your duties. Love them, educate them, and you will be happy in promoting their happiness.

7. You seek pleasure in the coarse enjoyments of the wine shop, and this so-called happiness consists in poisoning your body and your soul.

8. Avoid those fatal places, and return to your family, given to you by God that you may love them.

You were happy when young, when your good and kind mother lavished on you her caresses. She also was happy, because she loved you.

9. True, we must live; our body has wants which must be satisfied. But real wants are so few, and so little is required to live. You have hitherto mistaken artificial wants for the necessities of life. Perfect yourselves, as Christ wishes, become moral beings, as I ask you, and you will have no more artificial wants, for these wants have their origin in your faults and vices. Get rid of your faults and vices, and you will suddenly become rich. You will no more spend enormous sums at the wine shop, to gratify your vices, and half these sums you will find more than sufficient to keep you and your families.

10. The promises of Christ will be accomplished. You have made efforts to become "perfect even as your Father which is in heaven is perfect." That has sufficed to change your material condition. You have got rid of your failings, which were the cause of your expenses; those failings having been cured, the expenses cease. The money you used to spend to purchase poison you will now employ to

live, and as little is required to live, you will have too much money; you will be able to make use of it for charitable purposes, and to assist others, and to succour unforeseen misfortunes.

XVII.

1. I now, My Lord President, return to the question of "moral" saving. It is much more efficacious than economical saving.

2. I spent my old age in advocating saving. Yet I must admit there are misfortunes it cannot alleviate.

3. An industrious working-man, we will say, saves money regularly and incurs no unnecessary expense. Suddenly sickness attacks him, he becomes unable to work. His savings are exhausted, he is going to fall into poverty.

4. Such unforeseen misfortunes are too frequent. Every day death, more cruel than sickness, carries away a father or a mother, the children being left unprotected. No savings can possibly fill up such gaps. Where shall a remedy be found? Christ has given it when He said to His disciples, "Love one another."

"Moral" saving, as I have explained it, must bring about moral improvement. And what is the law of perfection announced by Christ? *Charity.*

6. Charity is more inexhaustible than all the Savings Banks in the world. Charity eradicates the vice of vices: selfishness. Those whom charity guides do not live for themselves, they live for others; they do not think of themselves, they think of others. Thus it is that the treasure of charity increases as it spends itself, and it can never be too full.

XVIII.

1. By saying that charity is the remedy for all evils, I do not intend to extol almsgiving, which degrades and lowers the poor proletarian classes.

2. To my mind charity is inseparable from moral improvement. And the law of perfection is universal; all,

rich or poor, are subject to it. It destroys the leper of souls: selfishness; and if we succeed in curing it, we shall have found a remedy for all evils. Every one will find in himself a treasure; artificial wants will disappear, and they are the wants of selfishness; each of us will become rich by degrees, as he eradicates those parasitical plants which prevent the good seed from growing. And as the bad seed will disappear, the good herbs will shoot out great branches to such an extent that there will be more remedies than evils on earth.

3. But in order that this miracle should be accomplished, there must be a new kind of charity as well as a new kind of saving. That new kind of charity I also call "moral," so that it should not be confounded with almsgiving. The latter refers to the body; "moral" charity refers to the soul; but in the same way as "moral" saving reacts on the material condition of those who practise it, so does "moral" charity act both in a material and intellectual manner. We shall thus promote the moral and intellectual development of all human creatures, beginning with the younger, but without excluding the older, generations. The result will be an immense solidarity of the human race, all the members of which will co-operate in the work of improvement described by Christ as the ideal destiny of each of us.

XIX.

1. Saving, as I understand it, is a moral fact, and facts are not noted by means of statistics.

2. I can, however, assert that "moral" saving increases in our schools. This is not in contradiction with what I have stated in the first part of this lecture.

3. I have admitted that we had been led in a wrong direction; but we stopped in time to continue our advance in the path we had first taken, and which was the right one—that of "moral" saving.

I have resumed preaching in young children's classes, and have been happy to find that one can obtain every-

thing from children by kindness. Affection is to them what sunshine is to plants; it gives them life, and one can obtain everything from children by kindness.

4. Christ, the Great Teacher of Charity, preached charity as the law of laws; yet, after two thousand years of Christianity, selfishness even now divides men and social classes.

5. The great aim of moral education is to diffuse charity among the people.

6. The ideas to which I only allude here, are exhaustively expounded in a book which I will shortly publish, entitled, 'La réformation morale des classes laborieuses.' As soon as published I shall offer it to Lord Reay. In this book "moral" saving and "moral" charity are treated at length, as also the "teaching of charity."

7. I beg to call the earnest attention of the Conference on Education to these questions.

8. To prevent the Conference from entering upon too wide a range of discussion, I beg to propose a few resolutions embodying my views, and within which the debate may be circumscribed.

RESOLUTIONS PROPOSED BY MONS. LAURENT, ON SAVINGS IN SCHOOLS (*Épargne scolaire*).

First Resolution.

1. The principle of "Savings in Schools" is based upon the omnipotence of education.

2. It is the application of the idea of Leibnitz. Let the young generations be educated, and mankind will be transformed.

3. Nothing can be more evident.

4. The existence of mankind is nothing else but the development of our physical, intellectual, and moral faculties.

5. He who presides over this development holds in his hands, *ipso facto*, the destinies of the human race; he

transforms mankind by perfecting it, if the education is properly directed; but if he is acting on wrong principles, he will corrupt mankind by allowing it to deteriorate.

6. The system of savings in schools is an irrefutable proof of what I say.

7. Several manufacturers have tried to promote saving among their workmen, by offering them the advantage of a higher rate of interest than usual; they have failed in their endeavours.

We have introduced the custom of saving in schools by teaching or rather preaching it to the children; and we have succeeded. Children five years old have told their parents of the existence of a Savings Bank, and explained to them the benefit of saving.

8. In my work on the "Moral reformation of the Working Classes" I propose to teach charity in schools.

This is no Utopian scheme. Charity is a virtue. Now every virtue can and ought to be practised. Therefore charity can be taught.

If, for centuries, care had been taken to develop the sense of charity in schools, there would be less selfishness in this world, I believe; and we should not hear of the antagonism of classes as one hears of hostile armies ready to fight.

Second Resolution.

"Teaching" ought to be such as to ensure an essentially *moral education*.

1. Here I have to confront an old prejudice which I must combat, for the essential principle of my lecture is at stake.

2. I read in one of the books used in our schools: "The object of going to school is to learn reading, writing and arithmetic."

3. No; such is not the object of going to school.

4. Teaching has for its object to develop and strengthen the child's intellectual and moral faculties. It is the

training of the intelligence and of the conscience, to which must be added the too-often neglected training of the body, which the Greeks never forgot.

5. Which, among the various faculties of man, is the most important? Which ought to be considered as our aim?

6. Christ will answer my question. He tells us what is the destiny of man in those mighty words: "Be ye therefore *perfect*, even as your Father which is in *heaven* is perfect."

7. What is that perfection which we are to seek? It is, beyond doubt, "moral" perfection. The chief object, therefore, of all teaching is to develop our moral faculties; it is by becoming better that we shall every day grow less imperfect: and that we shall, by degrees, approach to Divine perfection, as much as imperfect man can reach to the Creator's perfection.

8. Such is not the idea prevailing in our schools and among our teachers.

9. In all classes of teachers it is thought that the teacher's mission is to impart a knowledge of certain subjects or sciences. No one seems to think that "moral development" is the essential aim.

10. I confine myself to speak of what happens under my own eyes, and I suppose it must be the same everywhere. Until 1878 morality was not included in the curriculum of primary schools; the law left the teaching of morality to the priest, who displayed the same indifference as the legislator.

11. Even now there is in colleges and universities no moral teaching for all students. Therefore moral education does not exist.

12. When I say that all teaching ought to be such as to ensure an essentially moral education, I do not mean to say that special precepts of morality inculcated to pupils of all schools would satisfy me. The children's conscience must be developed and strengthened. Educational establishments have for their object to fashion men, that is,

moral beings. A few lessons in morality would therefore be insufficient for the purpose. The whole system of teaching must be framed in a moral spirit, and moreover must be practical, when it is considered that the aim is to enlighten and to strengthen the children's conscience.

13. Let us take saving as an example. How can we teach it? By having it practised at school.

14. I propose to teach charity in schools. How shall we teach it? In causing children and youths to contribute to charitable undertakings. By practice they will become charitable.

15. Here I must refer the reader to my new work on the "Moral Reformation of the Working Classes," as I cannot say everything in one paper.

THIRD RESOLUTION.

The morality to be taught shall be that of Christianity, of Christ, but unfettered by any dogma or Christian confession of faith.

1. This is the most delicate point of the resolutions I propose. I advocate the teaching of morality, and insist on that morality being that of Christianity, and, I add, of Christ, in order to exclude all sectarian morality.

Why, being a freethinker, do I propose a religious, instead of a philosophical, morality?

2. The moral education I desire must be based on a practical morality. Therefore it is necessary to set aside philosophical morality, which would vary according to the different philosophical systems, none of these having sufficient authority to be adopted as a standard; whilst there is a religion enjoying a universally acknowledged authority, namely Christianity; in England and on the continent of Europe we know of no other. It is the morality preached by Christ in the Gospel that I propose in my Resolution, setting aside all Christian sects.

3. As examples, I take two maxims upon which is based

my book on the "Moral Reformation of the Working Classes."

First, *Be ye therefore perfect, even as your Father which is in heaven is perfect.*

This maxim teaches us what our destiny is; we must know this maxim in order to understand what our duties are. It is a Christian maxim; Christ has preached it, but it is neither Protestant nor Catholic. It has also this advantage that philosophers accept it, and are at one with Christ in this respect that they also teach us the law of infinite perfectionment; but they do not add that man ought to be as perfect as our Father in heaven. In this respect the morality of Christ is superior to philosophical morality.

4. Every teaching requires a teacher, and an ideal to be taught. We have a teacher; it is He who created us, and in whom we shall live as Paul said. This permanent union of man with God affords a basis for the moral education founded on Christianity. God, our Father, inspires and guides us, and he does not withdraw his hand from us even when we deviate from the path of duty.

The second moral maxim from the Gospel, which is the basis of moral education, is also universal. Christian education has an ideal. Christ has expressed it in those words which bear the sign of perfection: *Love ye one another.* This maxim is also acknowledged by philosophers.

These two maxims suffice for religious education. It will be seen that it dispenses with dogmas, and that it holds aloof from every church or sect; and all Christian churches and sects recognise our two maxims which philosophers respectfully acknowledge.

These are characters of authority and universality, which enable me to recommend to you the resolutions based upon them.

Fourth Resolution.

"Moral Saving" shall be included in the curriculum of all schools, even of schools attended by the children of well-to-do or wealthy families.

In non-gratuitous schools "Moral" saving will serve as a stepping-stone to "moral" charity.

Fifth Resolution.

"Moral charity" shall also be practically introduced in all schools.

1. The combination of *Moral Saving* and *Moral Charity* is the crowning-piece of the work I propose in my lecture. Allow me, my Lord President, to dwell on the subject a few moments even at the risk of trespassing beyond the twenty minutes to which I am entitled.

"MORAL SAVING" AND "MORAL CHARITY."

1. Why must "Moral Saving" be taught and practised in the schools attended by children belonging to the well-to-do and wealthy classes?

2. If saving had only an economical aim, that of providing "for a rainy day," the resolution I propose having for its object to promote the custom of saving among all classes of the community, would meet with considerable opposition. It would be argued that there is no necessity for saving in families which will never suffer from hunger.

3. "Never:" that is saying too much. Revolutions which bring about reverses of fortune are so frequent in modern times that, even in wealthy families, the necessity is felt of making provision for the future of young girls brought up in opulence. Hence the foundation in Paris, London, and Berlin, of practical and sound educational establishments.

4. But let us dismiss the thought of accidental reverses of fortune. In my opinion, saving is essentially moral; the

aim of saving is to moralise children, by curing them of failings which produce artificial wants. Are not gluttony and daintiness to be found among children belonging to wealthy families, and later a taste for luxury and a longing for pleasures?

5. These are an inexhaustible source of artificial wants, and, consequently, of inconsiderate expenses, which ruin families, and occasionally bring about fearful disasters. In the book I am about to publish, I have related the story of a young lady who, by her extravagant expenses, led her husband to commit suicide. He was an advocate and professor, and she owed to him her position, her fortune, the consideration she enjoyed; in fact, everything. Young girls of position are much more exposed to temptations than their poorer sisters, and saving is strongly objected to by the vanity of parents.

6. It is certain that in our paying schools the savings are few. Parents do not like to save centimes; it hurts their vanity, and they cannot save francs. It will be a blessing for the children and their families when they are subjected to a common rule.

7. "Moral Saving" goes hand in hand with "Moral Charity" in paying schools.

8. I call "Moral Charity," to distinguish it from almsgiving, that kind of charity which appeals to the soul, and educates and moralises poor children and the young workpeople of both sexes.

9. This is how charity is introduced in schools. In gratuitous schools, clothes are given as rewards for good conduct. It is an instance of "moral" charity. I have advised young girls who attend paying schools to contribute by means of their savings to that charitable work. "Save," I said to them, "5 centimes every week; the schoolmistress will collect the money saved, and a charity-fund will thus be established. She will then purchase the necessary materials, cotton, linen, cloth, which you will make into various objects, dresses, aprons, stockings, to be distributed in gratuitous schools to the children who are

distinguished for their good conduct and industry. It will be a reward and an encouragement. And in this work of charity you, the donors, will be the most grateful.

10. "First you will practise that kind of saving which I call 'moral saving,' because it helps to cure you of your failings. You are fond of sweets. To be dainty, to eat cakes after having sufficiently eaten at meals, is certainly a failing, and failings must be got rid of, or they become vices. Well, the 5 centimes you will put by every week for your charity fund, will be so many useless expenses the less. You will in the end get rid of those artificial wants, and also of a very ugly failing. This is a great advantage of 'moral saving.'

'Moral Charity,' which you will practise in gratuitous schools, will be a greater benefit still. To do good is always a great pleasure, as you will find by experience; but the pleasure is twofold when you contribute both your work and money to charitable purposes. You will make a small sacrifice in not spending on dainties the 5 centimes you will save. Such privation will be the source of a very great satisfaction, caused by the consciousness of having done good at your own expense. But whilst doing good to others, you will also have done good to yourselves, since you will get rid of the failing of gluttony.

11. "Now, my dear children, think over what I have told you, then consult your parents, for children must never do anything without the advice of their father and mother. Then write me a letter to let me know what you have decided."

12. Excuse me, my lord, for telling you these children's stories. This particular fact has been very gratifying to me, and I trust it may prove equally so to your lordship.

13. When, a few days later, I returned to the school, I at once saw that the children and I were agreed. One of the girls, however, was crying; her mother had withheld her consent. "Don't cry," I said, "you will find that your mother shall give you permission to do like the other girls."

We read the letters which, written by children eight

years old, swarmed with mistakes, but were overflowing with good feelings. I placed them among my treasures; never was I so rich.

14. This is how charity is taught—by practice. Charity is natural to man; it only requires to be given an opportunity of developing itself. The dear children thanked me for having explained to them how they were to practise charity. They set to work at once.

15. They will never forget the lessons in charity given them when at school. Teaching charity, as will be seen, is as gratifying as it is easy. This is one of the happiest remembrances of my visits to schools. Need any one be surprised at my visiting schools daily?

16. I have said that "Moral" charity is an inexhaustible treasure. Yet a saving of 5 centimes weekly suffices to keep it full because there are millions of children, each of whom gives 2 francs 60 centimes yearly. How wonderful in its results is this charity. It is no more the lowering and degrading almsgiving. Failings and vices are eradicated, artificial wants disappear. The Sunday centimes are employed in distributing good conduct rewards. Useless expenses are no more incurred. On all sides savings are made which multiply wealth and reduce artificial wants. And the greatest of treasures will be gathered: good qualities and virtues.

This kind of saving, statistics cannot adequately represent. It surpasses all imaginable figures. A vice reformed, an acquired virtue, have more value than all the millions that could be amassed.

M. DE MALARCE then read a paper, of which he has omitted to furnish a copy.

Mr. W. OULTON said the labours of Mons. Laurent and Mons. de Malarce first directed attention to this subject, and led to the establishment of School Savings' Banks in Liverpool. He remembered very well several years ago reading a publication of Mons. de Malarce, where he referred to the influence of savings on the charitable emotions and instincts of children, and the statistics of one Bank or series of Banks in Bordeaux were considered in connection with the floods which had occurred there at that time, and, in connection with the total of the children's savings it was stated that that did not include the sum contributed by them towards the sufferers from the inundations. That produced on his mind at the time a very considerable effect, because he had often heard in conversation an objection raised to the instruction of children in thrift on the ground that it might lead them to miserly habits, and this was an illustration of how futile and groundless was any such apprehension.

SCHOOL SAVINGS BANKS.

By W. OULTON.

THE title is intended to convey the same relation as the term "school books" does, that is, the same direct and educational connection. If this is lost we lose at once the educational character of the school savings' bank, and, however useful a brief treatise on thrift as a virtue to be generally practised might be, it would be out of place here in a conference on education. You might as consistently under a title of "school books" enlarge upon the advantage of public libraries to those who have been taught to read

as regard "school savings banks" merely as savings banks in schools where those already provident can deposit their savings. A school savings bank, as understood by me, is as much the lesson book of thrift as their respective primers are the lesson books of geography, history, etc. The question we have before us is, is thrift a subject that should be taught in our public elementary schools, and what is the best way to teach it? and the reply is, it certainly is, and the best way of teaching it is by savings banks in the schools, conducted as part of the school work. Education is formative rather than distributive; it moulds character more than it imparts knowledge, and its effects are therefore more generally seen in the playground and in the home than in the examination room. Few scholars possess the knowledge necessary to pass a stiff examination, or are conscious of any great increase in their stores of information, but thousands feel the influence of the discipline, application, patience, endurance and obedience, which is day by day upon them, and evidence every day and long after school is left the moulding and creative power of education. Don't think I am labouring upon a point already beaten out to thinness. There are two streams of tendency among educationists, and you will find them always, at least I always have, on any educational committee. The one is most anxious about "results" as evidenced by the percentage of passes, and would consequently occupy school time in imparting knowledge. The other realises as well the importance of exercises which, though they may not impart knowledge, mould character into strength and beauty, and these have sometimes to struggle, in order to secure a little space upon the time table.

My conviction is, that you may do almost anything with youth at school, and I have the courage of my convictions. If it *is* desirable that youth should grow up thrifty and provident, then teach him at school the virtue of thrift. It is your surest, nay, in thousands of cases your only chance of saving him when a man from the humiliating miseries which accompany improvidence. As the twig is bent the

tree inclines. Spending is a habit, and saving is just the same. The inclination is everything. If the mind is inclined to spend, extravagance is sure, except in some very rare cases of perfect self-control, to follow. If the mind is inclined to save, thrift, prudence and carefulness, except in some very rare cases of morbid miserliness, are sure to follow. No habits cling like those formed at school. A liar, a cheater at his games, a mean truckler to the big and a bully of the small, are much the same in the world as they were at school. And so, if thrift is taught and thrift is practised in the school, is it not almost a moral impossibility that the next generation will be as thriftless as the present? But thrift, to be taught effectually, must be practised. Experience seems to prove that the most effective agent in lessening the natural tendency to improvidence is the pleasure of possession. Hence the advocacy of the introduction of penny-banks as part of the school curriculum. By their means the children *can* save; they are to the lesson on thrift what pen, ink, and paper are to the lesson on writing—the necessary concomitant; they are the visible illustration in an object lesson on economy. National Education is not a reasonable reflection of its name, if it does not specially adapt itself to special national needs. The careless as well as the vicious improvidence of our people is England's reproach. And the extravagance of the wealthy is parsimony to that of the poor; they, indeed, out of their riches spend largely, but these poor spend all they have. Surely there is an absence of proportion in speaking with pity or indignation of the improvidence of the working classes, if at the same time we allow their children to pass through our schools without making any direct effort, so to shape the education we give them, that the influences of a slatternly home and improvident parents may be modified if not annulled.

Educational movement since 1875 has undoubtedly been in the right direction as regards this.

The subject and the system—thrift and school banks—have been recognised with approval by our great educa-

tional authority in many ways, and progress has been made. In the Blue Book for 1882–3, on page xix. of the Report of the Committee, it is stated "Savings banks have been established in 1376 schools." In 1879 there were only 848; in 1880, 1087; and in 1881, 1187 school banks. This increase is largely owing to the encouragement given from time to time by the Education Department, and to the individual efforts of some of Her Majesty's Inspectors, notably to those of Mr. J. G. Fitch, whose suggestion, though not carried out, was of appreciable influence when made (Blue Book, 1878–9, page 558), and was supported by an argument of continued excellence, viz., that "the formation of thrifty habits should be encouraged *pari passu* with theoretical lessons on economy." In July, 1881, the Education Department issued a circular (No. 196) to managers and others, devoted entirely to the advocacy of School Savings Banks. In it their Lordships say, "To learn how to economise slender resources, how to resist temptation to needless expense, and how to make reasonable provision for future contingencies, is an important part of education," their Lordships go on to say, "The annual return (Form IX.) required to be filled up by managers already contains questions respecting the existence of a bank in the school, the number of depositors, and the amount of the sums accumulated; and their Lordships will gladly learn that the number of satisfactory replies to these questions increases largely in each succeeding year." In the instructions to Her Majesty's Inspectors (Circular 212), issued in August 1882, and with direct reference to the Code (Mr. Mundella's) describing the features of an "Excellent" school, it is expressly required that where circumstances permit it must have its savings bank.

But though progress has been made and official recognition emphatic in approval, much has to be done.

Thousands of departments are without school banks and tens of thousands of scholars without efficient instruction in the art of saving. Liverpool is large enough as a field of observation, and from what has occurred there any

Summary of Business transa

	Number of Banks.	In Treasurer's hands, 20th November, 1881.	Receipts. Amount of Deposits.	Receipts. Number of Deposits.	Receipts. Interest on Deposits.	several departments on 20th November, 1882.	Per cent. of open Accounts on the names of the roll.
TOTALS, 1882	69	1155 8 11	3332 8 6	133097	23 8 1	7054	40·18
TOTALS, 1881	64	1107 9 7	3011 0 10	112315	22 9 5	4734	39·69* 46·18
TOTALS, 1880	64	930 1 5	2751 0 7	112031	20 12 1	4658	44·7
TOTALS, 1879	60	764 18 1	2426 11 10	100350	18 9 6	3181	41·7
TOTALS, 1878	39	510 11 0	1996 7 0	79073	14 3 2	8454	47·
TOTALS, 1877	34	173 12 0	950 1 2	36647	5 4 0	7133	39·
TOTALS, 1876	11	...	401 15 9	14359	...	...	...

e page 627.

educationist may learn the necessity, the difficulty, the success of this principle. Practically it was first established in 1875. A gentleman who has been long before his fellow-townsmen as an earnest and practical exponent of the principle of savings banks, Mr. Thomas Banner Newton, the actuary of our Bold Street Savings Bank, associated himself with the Liverpool School Board in an endeavour to introduce this principle into the public elementary schools of our town. At the suggestion of the School Management Committee a meeting of managers and teachers was convened in the Bold Street Bank, under the presidency of the Chairman of the School Board, on April 7th, 1875, to hear a lecture by the Rev. T. E. Crallan, chaplain of the County Asylum, Haywards Heath, Sussex, on this subject. At this meeting resolutions were passed approving the introduction of these banks into schools, and a committee of managers and teachers was appointed to carry out the resolutions subscribed. That committee did its work quietly and efficiently; and a scheme for the working of the banks was drawn up and printed, together with forms of books to be used. The result is gratifying, as will be seen from the accompanying table of board schools alone.

It will be noticed that while the amount of deposits, number of transactions, and number of depositors have largely increased, the proportion of depositors to scholars on the roll has increased but slightly. I need not say that a large increase in this proportion is the only satisfactory proof that thrift is being efficiently taught. The total of school banks in Liverpool in 1883 was fifty-two, having 15,974 open accounts with £2,465 7*s.* 8*d.* to their credit. During the year there had been 260,043 transactions, representing £6018 lodged, £4075 drawn, and £1475 transferred to the credit of individual scholars with the Liverpool Savings Bank. In Liverpool our work is mainly done in connection with the Liverpool Savings Bank, through the Penny Savings Bank Association, of which Mr. T. B. Newton is the permanent Vice-President. The trustees of the bank are selected from the managers of the schools.

The books are given by the association, and kept (without fee) by the teachers. One feature of our system I attach much importance to—we require that once a quarter any depositor having accumulated upwards of ten shillings shall have that sum, or the multiple of it, transferred from the penny bank to an account in his own name in the Liverpool Savings Bank, whose pass book is furnished to him. This practice preserves the elementary and educational character of the school bank, and introduces the depositors to a savings bank which they may continue to use after leaving school, and which they will be all the more likely to use from having begun the practice before leaving just as if our elementary scholars could be induced to attend a course of evening classes or lectures while yet going to school, much would have been done to continue them when they do leave in a course of private study and self-education. In every place now, complete facilities for working school savings banks are given by the Post-office. Small books for the use of children have been prepared and are issued gratuitously by the Savings Bank Department, and the new method of saving by means of postage stamps may also, in some cases, be practicable and helpful. When we find the active thought of the best minds engaged on the great subject of National Education, thus converging with approving pressure on this feature of their work, there can be little hesitancy by reasonable men in accepting their conclusions and acting on their counsel. Teachers bear similar testimony. The introduction of a bank necessitates additional labour where labour is already heavy, but I have not met with an instance of refusal or objection on that account to its establishment. And those who have experience endorse the opinion expressed by the head master of one of our largest Board Schools in a letter which appeared in the educational papers.

"As the head master of a school which has one of the largest and most successful penny banks in Liverpool, I can speak with some authority respecting the remark that the work connected therewith must be immensely troublesome.

We have an average attendance of about 1100 children, and, as you will see by the balance-sheet herewith, at the close of last year we had 976 open accounts exclusively in the names of the scholars. During the year there were 18,090 transactions. The amount deposited was £367 8*s.* 11*d.*; transferred to Liverpool Savings' Bank, £92 10*s.*; withdrawn, £184 5*s.* 8*d.*; leaving, with that from 1877, a balance due to depositors of £161 14*s.* 11*d.* The number of weekly transactions is at present over 500, and yet this amount of business does not occupy the teachers of each department more than half-an-hour per week. But not only does the penny bank do good in this way; it also indirectly promotes regular attendance and prevents capricious removals—two of the greatest evils with which a teacher has to contend. A child who has an account in the school bank feels that he has some interest in the school, and makes a special effort to be present on the Monday when business is transacted; and as Monday is very often a day when a number of children would otherwise be absent, the penny bank aids the teacher in securing regular attendance. Again, with respect to capricious removals. It sometimes happens that a child goes home and complains of some fancied grievance which he has had to endure at school. The parents, without enquiring into the matter, determine to remove him, and the teacher knows nothing of it until he hears that the child is attending another school. If, now, that child were a depositor in a school bank, his money would be withdrawn, and the teacher would thus probably learn that he was leaving the school. The parent might then be seen, the grievance, real or imaginary, inquired into, and the matter amicably settled. Such has been my experience, and sorry indeed should I be if the usefulness of the school bank received any check."

This is encouraging. It is only, I am glad to testify, one of many instances in which teachers have proved that in everything which affects their important labour they are quick to learn and earnest to assist. And now there is a concurrence of testimony that teachers are experiencing a

decided assistance in their work of education from the nearness of association and the sympathetic intercourse which is established between themselves and their scholars in the working of the school banks.

It might be that a few generations of school boys and girls thus instructed in thrift would annihilate improvidence, or, if not destroyed, it would be reduced, and that is enough for me. The individual man is coming to the front once again, and laws and organisations are dwarfing. We are beginning to realise that the unwritten law of thrift is a better protection from drunkenness than the most stringent licensing law. The extravagances of Communistic Socialism are more easily refuted by the man who has something saved, than by the man who has nothing. To a Bismarck it may be easy, in Germany possible, to establish a State insurance of the people, but in England we shall have a greater resource in sickness and old age, heavier in amount, and less likely to play us false on demand, if we have thrift in the schools, than if a Government Bank be pledged to our relief. Whatever else is taught then, teach thrift, and teach it by a savings bank in the school, used in the school, and regarded always as part of the school curriculum.

DISCUSSION.

Mr. T. Banner Newton (Liverpool) said there was very little for him to add to what Mr. Oulton had said, but he hoped that if Mr. Oulton had convinced those who had heard him of the value of this work, they would all aid in developing it. Mr. Oulton said, the Educational Department had from time to time encouraged the formation of school-banks, and particularly laid great stress on their having issued a circular on the subject, but personally he must say he feared that was rather to encourage them to go on as they were without expecting any aid from the Department. He submitted that the time had now come

when they might fairly claim more direct recognition in the Educational Code. If education in thrift was as valuable as education in anything else, why should not the teachers be able to include this lesson in the ordinary time table. He feared that my Lords did not attach sufficient importance to the teacher's influence in the imparting of this lesson, and that the Savings Bank was regarded only as the means of saving, the educational side of the question being lost sight of. He could not speak more strongly than Mr. Oulton had done, on the absolute necessity of the bank being regarded as part of the school curriculum. It must be worked by the teachers to develop its full educational value, for in all his experience in Liverpool he had never known any bank succeed without the cordial goodwill and co-operation of the teachers, and he was sorry that they should have to do the work out of school hours. During all the time he had been engaged in this work nothing had distressed him more than that the bank was instrumental in imposing more work on the teachers, and he asked that the school banks should now be recognised in the code. He would suggest, for instance, that as there already existed an allowance of one hour a week, or so many a year for military drill, there might very well be half an hour allowed for the conduct of the school bank. Mr. Oulton had given an instance of the very large amount of business that might be transacted in that time, and such allowance would materially help the teachers, and would have a beneficial effect on the scholars. The bank at present must be conducted either before school or at the close, and naturally only those attended who wanted to transact business whilst the others were out at play. Now they could hardly expect children not to be more desirous of being at play than depositing in the bank. He was consulted about this very matter only last week. The bank should be carried on in the presence of the whole class, as it could be if half an hour were allowed without deducting it, and the example would help on the work. That was the way in which it was conducted at Ghent, and when he

visited that city and went round the different schools with M. Laurent and saw the work as represented in a pamphlet, which Mr. Fitch published in 1875, he found that it was quite the exception for any child not to be a depositor. He quite believed that if they had a more direct recognition of the bank, so that the work might be carried on in school time, this happy result might be realised in England.

Señor COSSIO said he should like to say a few words on Mons. de Malarce's paper, and he would endeavour to make himself intelligible in French. There were savings banks established in connection with a few schools in Spain, at Madrid, Valencia, and Barcelona, and there was also one in connection with the Institucion Libre in Madrid, where every effort was being made to make this scheme a means of moral education. There was, however, a question in his mind which he should like to submit to M. de Malarce, viz., in the first place, whether it was desirable that young children should have money given to them at all; and if they had, whether they should not be allowed to expend it in purchasing any little thing which they liked. It seemed somewhat doubtful to his mind whether a child were really educated in thrift, by having a few pence given to it, with instructions to take the money to school and put it in the bank. Under such circumstances it would not feel that it really had possession of the money, and therefore the moral lesson would be very incomplete.

Mr. JOHN BRIDGE asked if Mr. Newton's idea was that the whole class should be kept in for half an hour, or only those who belonged to the bank. It did not seem to him that if there were only 39 per cent. who were going to use the bank the others should be idly looking on, though certainly if an hour a week were allowed for military drill he saw no objection to half an hour for moral drill. Then there was another objection with regard to forcing masters and teachers to conduct these banks. If they were forced they would not succeed, but if they were taken up voluntarily they would. It had often come under his notice how small village banks had prospered where the lady who took a

keen interest in it had managed it herself; in such cases he had known the deposits to be as many as fifty or sixty a week; but when she had gone away for a holiday, and left it to somebody else, they dropped down to ten or twelve.

Mr. OGLE said it seemed as if this country, in moral and social good, were to proceed as the sap in trees did, from beneath upwards. As he walked through the Exhibition and saw what was taught in elementary schools the conviction was forced upon his mind that, in some respects, many of the elementary schools were far superior to those designed for the middle and upper classes; and now they might gather from the papers which had been read that a vast amount of moral good with respect to the cultivation of habits of thrift had already begun in elementary schools. He rose to express the hope that what had been already begun in those schools might soon be seen in action in schools for the middle and upper classes. He thought all would agree as to the truth of the common assertion, that the English people were emphatically the most unthrifty and wasteful in the world; they were very much less thrifty than the Scotch, and he believed both the Welsh and the Irish were superior in that respect; and almost all Continental nations excelled us in that virtue. But what could one expect of Englishmen, considering the way in which English boys were allowed to grow up with respect to the use of money? Already supplied with everything they needed, they were also supplied in excess with money when they went to school; it came to them entirely unearned, and they associated no ideas with it except that it was to be had in order to be spent. It was got without labour, and they had no idea of its being accumulated with patience, or of exercising any self-denial in connection with it. It was a mere means of self-gratification at the expense of others, and often in some of its lowest forms. When boys grew up with such habits, what wonder that when they entered on manhood they were found to have no disposition to self-denial or self-control, or anything approach-

ing to self-sacrifice; and very often they were very slow, even to be willing to earn, and had very little notion of doing anything with money except spend it as rapidly as possible. Some good would arise if even the comparatively small audience left the room with the determination to use what influence they had in insisting, with regard to any schools with which they were connected, that there should be some systematic culture of this virtue of thrift. It was very easy for head masters to say as they did that there were traditions which no human being could set aside; that things had been going on in a certain way at Eton and Harrow for hundreds of years, and that they must remain unaltered, but English mothers and fathers could if they pleased change all that. Let them give the preference in future to schools in which the master had the conscientiousness, the courage, the resolution to insist on habits of thrift, and on the formation and maintenance of a bank such as they had heard of; let the scholars be shamed into thrift by the good example set them by children in what was termed the lower order of society. They must also do something towards teaching boys the value of money by a very simple arrangement; if, instead of allowing so much pocket-money arbitrarily, a regulation were made, and strictly enforced, that the amount of pocket-money should vary with the boy's conduct, and on his application to his work, so that if he earned his pocket-money by good conduct and application, great good would be done. He was glad to hear it stated that this habit of saving had tended to produce a habit of beneficence. The young were very ready to give, and it was miserable the way in which they were generally trained to give from other people's pockets. Perhaps that was better than nothing, but how much better it would be that boys should have savings of their own from which they could give, and by self-denial produce a fund, a part of which he might give to the poor who needed it. There need be no fear of habits of parsimony being developed, they were not indigenous in England and were not likely to spring up. He believed they would

all find it very difficult to find a parsimonious man amongst their acquaintances. Most Englishmen were very hard-working and industrious; they spent their time in making money, and left themselves no time sufficient to carefully dispose of it, and if it were not every now and then for a very frugal and sensible wife, that money would be very ill applied. The mere act of succeeding in life and making money was pleasurable, but few men became lovers of money for its own sake, and very few boys would. The benefit of such a habit amongst the population would be this: the doing of any one thing right and good, the cultivation of any one virtue tended towards a general amelioration of the whole character, and a boy could hardly be frugal, thrifty, orderly, beneficent from his own carefully acquired funds without becoming more obedient, more studious, more orderly, and more virtuous in every respect. He sincerely hoped this movement would spread, and that banks would be formed, not only in all elementary schools, but in those for the middle and upper classes.

Mr. ROOPER wished to ask one question of Mr. Oulton, which, as a school inspector, he had found a practical difficulty. In a large school there would be perhaps 700 or 800 children, and it would be a common thing for one of the junior teachers to conduct a bank, and he wished to ask if Mr. Oulton could suggest any guarantee which could be obtained from the teacher, who received the money that he should not prove a defaulter. He could not help thinking it was a great temptation for a young man to have a considerable sum of money pass through his hands, and if that danger could be thoroughly guarded against he had little doubt that the system would be more generally adopted, for he was quite certain that this difficulty was somewhat widely felt.

Mons. DE MALARCE then replied, in French, to some of the observations which had been made. He was understood to say that in some places these savings banks in schools had been established at the request of the municipalities. In reply to Señor Cossio he said it was a custom in all

countries to give children pocket money, generally a few half-pence weekly, and occasionally larger sums on birthdays and other special occasions; and it was, in his opinion, very much better that they should be encouraged to put this money into savings banks than to waste it, as was generally the practice, on pastry, fruit, and unwholesome sweetmeats.

Mr. OULTON said he had much pleasure in answering the enquiry of Mr. Roper. Of course the difficulty existed, because you could not intrust the handling of money to any one without the risk of his being dishonest, but as a matter of fact the difficulty was very slight. In all the transactions during the years he had mentioned in the paper, there was only one instance of defalcation, and the checks adopted were such that if they had been carried out to even a small degree in that case the detection would have been very early, and the amount of loss would have been exceedingly small. The business was transacted in such a way that there could always be a check, two persons at least must be present at every transaction; and in a large school, especially if no other work were being done at the same time, that presented no difficulty. The scheme had been worked out with a great deal of thought, and probably was as near perfect as it could be made by the exercise of thought and care. He had no doubt that other methods could be designed equally safe. Perhaps one specially devised with a view to the circumstances of each school, the class of children, and the number of teachers on the staff would be the best. Their scheme was in print and was at the service of any one interested. He would make one observation with reference to what he gathered to be the point in dispute between Mons. de Malarce and Señor Cossio. As he understood the point was that children had a right to do what they liked with their own; and if they came into possession of money by gift or otherwise no one had a right to interfere with them, but they should be at liberty to spend it or save it as they liked. Now he believed as little as any one in interfering unduly with the

liberty of the subject, but he could not quite go the length of believing that the mind of a young child was like a white sheet of paper on which nothing but good could hereafter be written. They did not treat children in reference to any other matter in so non-natural and nonsensical a manner. Children were entitled to food, but what a foolish parent that would be to allow a child to eat as much as it could, it would assuredly lead to sickness. Nature knew nothing of moderation; it was a moral quality and had to be introduced into the character of a child. The child might have the handling of money, and ought, up to a certain point, to have it under its own control, because if you took away all individual action it would be merely binding the child in moral straps and chains which it would throw off when it grew older and be subject to every temptation without any of the moral restraint or thrifty habits which they sought to encourage by means of these savings banks. They might, therefore, allow a reasonable freedom to children in the expenditure of money in order that they might not grow up altogether nincompoops, without any sense of self-restraint, but they should at the same time be careful to control their natural instincts, which if left to themselves would, when they possessed money, lead only to extravagant expenditure.

The CHAIRMAN (Mr. Magnus) said, before separating it was his pleasing duty to offer the sincere thanks of the meeting to Professor Laurent, Mons. de Malarce, and Mr. Oulton for the extremely interesting papers which they had presented. Some apology was due to them for the smallness of the meeting, which he could only attribute to the counter attractions going on in the other rooms. The papers had been of great interest, and seemed to have supplemented one another exceedingly well. It was satisfactory to know that in such different countries as France, Spain and England similar views were held with regard to the advantages of introducing savings banks into schools. It struck him that perhaps Professor Laurent laid rather too much stress, if possible, on the educational

side of the question, and did not make use sufficiently of other motives which could be very beneficially employed. He was pleased to find by the paper of Mr. Oulton that, while giving great weight also to the educational value of savings banks, he considered it advisable to place before the children the importance of making some provisions for contingencies in the future. The interesting controversy between Señor Cossio and Mons. de Malarce did not seem to have been altogether satisfactorily settled, and he could only hope that before the next Educational Conference took place in this country those gentlemen would be able to agree on the points in difference between them. He did not know that the question had been rendered much more lucid by the remarks made upon it by Mr. Oulton, who did not appear to him to have gathered quite clearly what was the point in dispute; this was no doubt due to their inability to follow quite satisfactorily the foreign language. One remark made by Mons. de Malarce was an extremely interesting one, namely, that his experience showed that really more money was saved in poorer districts than in those where the parents were more wealthy, and for that strange phenomenon he gave a very clear and philosophical reason.

INDEX.

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, STAMFORD STREET AND CHARING CROSS.

A

DESCRIPTIVE CATALOGUE

OF THE

OFFICIAL HANDBOOKS,

CONFERENCE PAPERS, LECTURES, ETC.,

ISSUED BY THE EXECUTIVE COUNCIL

OF THE

INTERNATIONAL HEALTH EXHIBITION,

1884.

"The authors have been carefully selected, and the information conveyed is generally both useful and trustworthy."—*Times*.

"Among the actual results of the opening of the Health Exhibition, not the least important is the issue of a series of Official Handbooks that practically illustrate the science of health in all its manifold aspects........The general excellence of the first instalment of these handbooks promises well for the value and completeness of the series; while the price at which they are issued, should assure the success they merit."—*Saturday Review*.

LONDON:
WILLIAM CLOWES AND SONS, LIMITED,
Official Printers and Publishers to the Executive Council,
13 CHARING CROSS, S.W.

For the HANDBOOKS, CONFERENCES, *and* LECTURES *in Volumes, see page* 8.

A LIST

OF THE

OFFICIAL PUBLICATIONS

ISSUED BY THE EXECUTIVE COUNCIL

OF THE

INTERNATIONAL HEALTH EXHIBITION.

WM. CLOWES & SONS, LIMITED, 13 Charing Cross, London, S.W.

OFFICIAL HANDBOOKS.

Health in the Village.

By Sir HENRY W. DYKE-ACLAND, K.C.B., M.D., D.C.L., F.R.S., etc., etc. *Illustrated.* Second Edition. Price 1*s.*

Describes graphically an English Village in the 'Presanitation' period, and the misery of the people. It then states the ESSENTIALS OF HEALTH in an Agricultural Village; Dwellings; Water Supply; Removal of Refuse; Education; Occupation; Recreation; and Care in Sickness. It gives illustrations from the properties of large Landowners, and compares Past and Present. There are 50 Woodcut Illustrations.

Healthy Nurseries and Bedrooms, including the Lying-in Room.

By Mrs. GLADSTONE. Price 1*s.*

This book attempts to bring before the public the chief points in connection with the subject it deals with, in a popular form. Relying for scientific facts on thoroughly trustworthy authorities, the authoress has endeavoured to clothe them in language which will appeal especially to wives and mothers, while giving such exact descriptions and directions as shall enable the suggestions to be carried out by an ordinary reader.

Healthy and Unhealthy Houses in Town and Country.

By WM. EASSIE, C.E., F.L.S., etc. With an Appendix upon the Water Supply and Discharge of Sewage for Country Houses. By ROGERS FIELD, B.A., M.I.C.E. *Illustrated.* Second Edition. Price 1*s.*

The body of the Handbook deals with healthy and faulty sites for houses; the arrangement of houses as regards general convenience; proper and improper drainage; with details of all kinds of sanitary equipments for a house from basement to attic; ordinary water supply and flushing of drains, and instructions to householders, etc., in *town and country.* The Appendix treats upon the secretion of, and the supply of, water for *country* houses, and for methods of disposing of the sewage.

Healthy Schools.

By CHARLES E. PAGET, M.R.C.S. Price 1*s.*

Refers to general considerations of site; building and planning; ventilation; lighting and warming; arrangement of offices; and regulation of desks and seats in schools of all kinds. Deals with the special diseases apt to arise from neglect of such considerations, and points to the great advantages of good playgrounds; reviews the questions of feeding, school-hours, and the controlling of infectious illnesses.

Healthy Furniture and Decoration.

By ROBERT W. EDIS, F.S.A. *Illustrated.* 2nd Edition. Price 1*s.*

Preliminary Remarks—Unhealthiness of Wooden Houses—Ventilation and constructive decoration—Healthiness of electric lighting in comparison with gas, oil lamps, and candles—Present bad system of leasehold tenure—Diseases attributable to badly built and filled houses—Sanitary decoration—Healthy treatment of floor and wall surfaces—Influence of colour on the optic nerves—Paper hangings—Washable papers—Unhealthiness of stuff hangings—Constructive fittings—Arrangement of different rooms—Healthy treatment of walls and fittings.—Bedrooms and Nurseries—Lavatories—Mantel-pieces—Smaller fittings of the house—Ornamental plaster-work—Leather papers, etc., for wall covering—Conclusion.

Health in the Workshop.

By JAMES B. LAKEMAN, one of Her Majesty's Inspectors of Factories. Price 1*s.*

CONTENTS.

PART I.—Progress of Factory Legislation from First Act in 1802 to Last Act in 1883—Causes which led to each extension—Diseases and mortality consequent on employment in certain trades—Successful efforts to free children from ignorance and oppressed toil—Improvement in physical vigour and development.

PART II.—Accidents: their causes and extent—where most frequent—why under more stringent regulations not reduced in number nor severity. Dangerous Machinery—how fenced—Cleaning machinery when in motion—Advice to operatives.

PART III.—Sanitation: where most neglected—Effect of employment in noxious trades—Unconverted dwellings used as workshops prejudicial to health—Industries where females are employed in unsuitable work—Degeneracy and deformity of operatives—Gradual restoration to former condition of sturdiness—Deficiency of closet accommodation, and appliances.

PART IV.—Ventilation: neglect of general defect in structural arrangement of workshops—Temperature—Overcrowding—Artificial warming—Mechanical ventilation—Diffusion of air—Examples of modes of ordinary ventilation.

Manual of Heating, Lighting, and Ventilation.

By Captain DOUGLAS GALTON, C.B., F.R.S., &c. *Illustrated.* Second Edition. Price 1*s.*

Ventilation and Warming combined; Purity of Air; Movement of Air; Warming of Air. Town air is impure from Organic Matter and Smoke—Methods for diminishing impurity, providing pure air, and removing vitiated air in houses are shown—Heating by open fires, warm air, hot water, steampipes, and gas explained. Light arises from incandescence—Vitiation of air by lighting is explained.

Diet in Relation to Health and Work.

By ALEXANDER WYNTER BLYTH, M.R.C.S., F.C.S., &c. Price 1*s.*

Division I.: First Principles—Food and Work. *Division II.:* Food Equivalents—Divisions of Food—Digestibility of Food. *Division III.:* Flesh and Milk. *Division IV.:* Chief Sources of the Carbohydrates. *Division V.:* Leguminous Vegetables—Fruits. *Division VI.:* Tea, Coffee, Cocoa, and Chocolate. *Division VII.:* The Principles of Diet—Diet in relation to Work—Diet in Development—Diet in Mental Exertion—Diet to reduce Fat—Diets to make Fat.

On the Principles of Cooking.

By SEPTIMUS BERDMORE. Price 1*s.*

Introduction—Elements—Utensils—Verbs which illustrate Principles—Choice and Preservation of Meats—To Roast—To Bake—To Grill—To Fry—To Boil—To Simmer—To Stew (Soups)—To Stew (Sauces)—To Braise—To Baste—To Brown and Clarify—To Flavour—To Serve—Pastry—Kickshaws, or Hors d'Œuvre—Salads—Conclusion.

Food and Cookery for Infants and Invalids.

By CATHERINE JANE WOOD. With an Introductory Chapter by W. B. CHEADLE, M.D. Price 1*s.*

Food: Its uses in the economy of nature—Component parts—Relative proportions. Infants: The mistakes in feeding; quantity, time and manner—The results of those mistakes—In Growth—In Physique—In After Life—Rational Feeding and its great importance. Invalids: From what Cause—How affected by Food—Diseases whose aggravation or cure is affected by Food—Characteristics of Sick Dietary—Cookery.

Alcoholic Drinks.

By JOHN L. W. THUDICHUM, M.D., F.R.C.P. Price 1*s.*

Wines of France, Germany, Austria and Hungary, Spain, Portugal, Atlantic Islands, Italy, Greece, Cyprus, The Crimea, Asia, Africa, America and Australia; British or Domestic Wines; Beer; Distilled Spirits; Liqueurs.

Water and Water-Supplies; and Unfermented Beverages.

By JOHN ATTFIELD, Ph.D., F.R.S., etc. Price 1*s.*

This Handbook includes a very full account of the sources, natural properties, qualities, etc., of all descriptions of water, "the basis of all beverages"; treats of the water-supplies of the city and the country; and embraces the preparation, purity, wholesomeness, etc. of aërated drinks, tea, other "teas," coffee, cocoa, and chocolate. A chapter on milk is added.

Salt; and other Condiments.

By J. J. MANLEY, M.A. Price 1*s.*

History of their Use in Ancient and Modern Times—Traditions, Customs, Superstitions, Associations connected with—Sources of Supply—Opinions, Ancient and Modern, as to Dietetic value, and Hygienic and Medicinal properties.

Legal Obligations in Relation to the Dwellings of the Poor.

By HARRY DUFF, M.A. With a Preface by ARTHUR COHEN, Q.C., M.P. Price 1*s.*

A summary of the law at present available for the prevention of overcrowding; the removal of nuisances; the demolition and reconstruction of unhealthy houses; showing the persons upon whom such obligations rest, and the manner in which they ought to be discharged, both in the metropolis and other parts of England.

Our Duty in Relation to Health.

By G. V. POORE, M.D., F.R.C.P. Price 1*s.*

This book is intended to show that each individual is morally responsible to himself and his neighbours in the matter of health; that national health depends upon the health of individuals; that health largely depends upon personal thrift and economy, and that without the intelligent assistance of individuals public authorities can do little. "Our Duty" is discussed in Five Chapters, *The House*, Water, Air, The Right Use of Refuse, and *Burial.*

Laboratory Guide to Public Health Investigation.

By W. WATSON CHEYNE, F.R.C.S.; and W. H. CORFIELD, M.D., M.A., F.R.C.P. With Catalogue as an Appendix. *Illustrated.* Price 1*s.*

The work done in this laboratory deals with the life history of the minute fungi and bacteria, more especially with those which are parasitic on plants and animals. The study of fermentations is also included. The cause of the various communicable disease is the chief matter of study, as well as the study of the means required for destroying the virus, of interfering with its growth, or of converting it into a useful vaccine material.

Physiology of Digestion and the Digestive Organs.

By ARTHUR GAMGEE, M.D., F.R.S. Illustrated. Price 1*s.*

Fermentation.

By Dr. C. DUCLAUX, of the Sorbonne, Paris. Price 1*s.*

The object of this book is the general study of ferments. It deals successively with their functions in the world, their influence on health and disease, their various modes of nutrition, their analogy with the constituent cells in the bodies of the higher animals, and the description of their contest with these cells.

Infectious Diseases and their Prevention.

By SHIRLEY F. MURPHY, M.R.C.P. Price 1*s.*

Infectious diseases cannot be prevented unless their nature is understood. Reasons for believing that they are caused by the growth in the body of living organisms.—Circumstances under which these may be introduced into the body, and the means for preventing such introduction.—Methods of rendering the body proof against infection—Destruction of infection.—General precautions.

Cleansing Streets and Ways in the Metropolis and large Cities.

By WILLIAM BOOTH SCOTT, M.Inst.C.E. Price 1*s.*

London Water Supply.

By Colonel Sir FRANCIS BOLTON, C.E. Price 1*s.*

CONTENTS.

GENERAL INTRODUCTION—Notes on Water Supply.—Water Filtration.—System of the London Water Supply: 1. Rivers, Springs, and Wells; 2. The Metropolitan Water Companies; 3. The Sources of Supply.—The Water Examiner.—Statistics of Supply.

HISTORY AND DESCRIPTION OF THE LONDON WATER WORKS—The Kent Water Works: On certain Well Waters in the Chalk District.—The New River.—The East London Water Works.—The Southwark and Vauxhall Water Works.—The West Middlesex Water Works.—The Grand Junction Water Works.—The Lambeth Water Works.—The Chelsea Water Works.

APPENDIX—Memorandum.—Rates of Supply.—Statutory Powers as to Dividends.

THE EXHIBITION OF 1884.

Fires and Fire Brigades.

By Captain EYRE M. SHAW, C.B., &c. Illustrated. Price 1*s.*

Athletics; or, Physical Exercise and Recreation.

Part I. By the Rev. EDMOND WARRE, M.A. *Illustrated.* Price 1*s.*

Athletics, or physical exercise in relation to health.—True view.—Greek and Roman.—Development in individual—child, boy, man.—Use and misuse.—Development of Athletics social.—History of, in England.—Public Schools, Universities.—Games.—Rowing.—Training necessary.—Other pastimes.—Drill.—Volunteers.—Exercise for children and elderly people.—Athletics in Board Schools.—Towns.—Working Classes.

Athletics. Part II.

Cricket, Football, Lawn Tennis, and Health. By the Hon. E. LYTTLETON, M.A., and GERARD F. COBB, M.A. Price 1*s.*

Introductory.—Games not really appreciated in England; the small number who play.—The benefit of exercise considered medically.—Games fulfil the requisite conditions better than taking a walk.—Importance of healthy games for women.—Various difficulties considered: How to obviate them.—The example of Germany.—How a cricketer should live.—Mr. Gladstone on the importance of chewing food.

Dress, and its Relation to Health and Climate.

By E. W. GODWIN, F.S.A. *Illustrated.* Second Edition. Price 1*s.*

This Handbook traces the changing fashions in dress from B.C. 2000. As far as the limits of the work allow, the modes of each period are described; with illustrations taken from contemporary sources. Many fashions are referred to climatic necessities or love of ornament; in this, as in other arts, beauty and fitness being not always reached or ever quite forgotten.

Accidental Injuries: their Relief and Immediate Treatment.

How to Prevent Accidents becoming more Serious. By JAMES CANTLIE, M.A., M.B., F.R.C.S. *Illustrated.* Second Edition. Price 1*s.*

This Handbook is intended as a guide, in simple language, from which the public may learn how to render efficient aid at the moment of injury. Not only are wounds, bruises, and broken bones, events of every-day occurrence, but a number of minor ailments, which might be relieved by the knowledge of some simple common-sense rules, are taken into consideration, and dealt with in a popular and yet not in a superficial manner.

Ambulance Organization, Equipment, and Transport.

By Surgeon-Major G. J. H. EVATT, M.D., A.M.D. *Illustrated.* Second Edition. Price 1*s.*

This Handbook describes in a popular manner the system of Ambulance Organization at work in the army for the relief of the sick and wounded in war. It also describes municipal ambulance systems. It deals briefly with the Red Cross organizations, and the various civil ambulance associations. It then describes the various equipments used in ambulance aid, stretchers, mule carriages, ambulance waggons, railway sick transport, marine ambulance arrangements and beds, with a short chapter on ambulance tents.

Schools of Art; their History, Work, Aims and Influences.

By JOHN SPARKES Esq., Principal of the National Art Training School, South Kensington.

CONTENTS: National Art Tendencies in the Past.—Origin, Progress, and Development of Schools of Art.—The Select Committee of 1835, 1849, and 1864.—Formation of Schools of Design—Department of Practical Art—Department of Science and Art.—Present Constitution and Objects of Schools of Art—Their Influence in Manufacturing Industries and National Taste, &c.

The Conference Papers and Lectures—the subjects of which are enumerated in the following pages—may also be obtained in a separate form uniform with the above Handbooks.

The following is the arrangement of the Handbooks, Conferences, and Lectures, as they will be published in Volumes:—

Price 7s. 6d. per Volume.

HEALTH IN THE DWELLING.

WITH PREFACE BY SIR HENRY W. DYKE-ACLAND, K.C.B., &c., &c.

VOLUME I. (*Published.*)

HANDBOOKS.

HEALTH IN THE VILLAGE. By Sir Henry W. Dyke-Acland, K.C.B., D.C.L., M.D., F.R.S., &c. &c. *Illustrated.*

HEALTHY NURSERIES AND BEDROOMS, INCLUDING THE LYING-IN-ROOM. By Mrs. Gladstone.

HEALTHY AND UNHEALTHY HOUSES IN TOWN AND COUNTRY. By William Eassie, C.E., with an Appendix by Rogers Field, C.E. *Illustrated.*

HEALTHY FURNITURE AND DECORATION. By Robert W. Edis F.S.A. *Illustrated.*

HEALTHY SCHOOLS. By Charles E. Paget, M.R.C.S.

HEALTH IN THE WORKSHOP. By James B. Lakeman, one of Her Majesty's Inspectors of Factories.

VENTILATION, WARMING, AND LIGHTING FOR DOMESTIC USE. By Captain Douglas Galton, C.B., F.R.S., &c. &c. *Illustrated.*

INDEX TO VOLUME.

VOLUME II. (*Published.*)

CONFERENCES.

MANSION HOUSE COUNCIL ON THE DWELLINGS OF THE POOR. The Lord Mayor, President; John Hamer, Secretary. 3, Queen Victoria Street, E.C.

"The Population of London and its Migrations"—"The Treatment of the London Poor"—"Overcrowding"—"Suburban Dwellings and Cheap Railway Fares"—"On the Creation of a Building Fund"—"Some Difficulties of Sanitary Legislation in the Metropolis"—"Suggestions to the Royal Commissioners."

ROYAL INSTITUTE OF BRITISH ARCHITECTS. Ewan Christian, President; William H. White, Secretary. 9, Conduit Street, W.

"The General Subject of the Construction of Houses with regard to Sanitary Arrangements—"The Sanitary Arrangement of Houses in London during the last 120 years"—"Drainage under Dwellings"—"The Impermeable Construction of Roofs, Walls, and Basement Floors, with a reference to Ventilation and Warming incidental thereto"—"The Construction of Chimneys"—"A Suggestion with regard to the Construction of Doors so as to afford opportunity of Escape from Fire; and another on an economical mode of Fireproof Construction, adapted in several instances in Public and Private Buildings"—"Sanitary Aspect of Internal Fittings and Decoration"—"The Hygienic value of Colour"—"Collection, Storage, Management, and Distribution of Water for Domestic Purposes."

SOCIAL SCIENCE ASSOCIATION.—Sir Richard Temple, Bart., G.C.S.I., C.I.E., President; J. L. Clifford-Smith, Secretary. 1, Adam Street, Adelphi, W.C.

"What conditions are essential for a Healthy Dwelling, whether in an urban or in a rural locality, and how far is it desirable that they should be rendered compulsory by legislation?"—"What, if any, restrictions in the interests of health should be enforced in connection with the employment of girls and women in Workshops and Factories?"—"Is it desirable that notification of Infectious Disease should be obligatory?"—"Is it desirable to legislate further respecting the duties of Medical Officers of Health?"

INDEX TO VOLUME.

VOLUME III. (*Published.*)

LECTURES.

ANGLO-SAXON HOUSES. By Professor J. Frederick Hodgetts.

HEALTHY HOUSES. By T. Pridgin Teale, F.R.C.S.

HEALTHY TOWN AND COUNTRY HOUSES. By W. Eassie, C.E.

FOUL AIR IN HOUSES. By Professor W. H. Corfield, M.D.

VENTILATION IN CONNECTION WITH WARMING AND LIGHTING. By Captain Douglas Galton, C.B., F.R.S.

HEALTHY FURNITURE. By Robert W. Edis, F.S.A.

DOMESTIC USE OF GAS. By Harold B. Dixon, M.A.

HEALTH IN THE WORKSHOP. By James B. Lakeman, one of Her Majesty's Inspectors of Factories.

SMOKE ABATEMENT. By Ernest Hart, M.R.C.S.

INDEX TO VOLUME.

Price 7s. 6d. per Volume.

HEALTH IN DIET.

WITH PREFACE BY PROFESSOR ARTHUR GAMGEE, M.D., F.R.S.

VOLUME IV. (*Published.*)

HANDBOOKS.

PHYSIOLOGY OF DIGESTION AND THE DIGESTIVE ORGANS. By Professor Arthur Gamgee, M.D., F.R.S. *Illustrated.*

DIET IN RELATION TO HEALTH AND WORK. By Alfred Wynter Blyth, M.R.C.S., F.C.S. *Illustrated.*

ON THE PRINCIPLES OF COOKING. By Septimus Berdmore.

FOOD AND COOKERY FOR INFANTS AND INVALIDS. By Miss Wood; with a Preface by Robert B. Cheadle, M.D., F.R.C.P.

WATER AND WATER SUPPLIES; AND UNFERMENTED BEVERAGES. By Professor Attfield, Ph.D., F.R.S.

SALT AND OTHER CONDIMENTS. By John J. Manley, M.A.

ALCOHOLIC DRINKS. By John L. W. Thudichum, M.D., F.R.C.P.

INDEX TO VOLUME.

VOLUME V. (*Published.*)

CONFERENCES.

CENTRAL CHAMBER OF AGRICULTURE.—Henry Chaplin, M.P., President; Major P. G. Craigie, Secretary. 7, Arundel Street, Strand, W.C.

"The Sources of our Meat Supply."—"The Causes which have Checked the Development of our Home Production of Meat."—"Home-grown Meat Supply and the Increased Production of Home-grown Meat."—"The Means of Securing the Supply of Meat to largely-populated Centres."

INSTITUTE OF CHEMISTRY.—Professor William Odling, M.A., F.R.S., President; Charles E. Groves, F.C.S., Secretary. Somerset House Terrace, W.C.

"Food Adulteration and Analysis," with Appendix.

BRITISH BEE-KEEPERS' ASSOCIATION.—The Baroness Burdett-Coutts, President; Rev. H. R. Peel, M.A., Secretary. Royal Horticultural Gardens, S.W.

"Foul Brood and its Prevention."—"Adulteration of Honey."

INDEX TO VOLUME.

VOLUME VI. (*Published.*)

LECTURES.

THE DIGESTIVE FERMENTS AND CHEMICAL PROCESSES OF DIGESTION. By Professor Arthur Gamgee, M.D., F.R.S.

REARING OF HAND-FED INFANTS. By Edmund Owen, M.B., F.R.C.S.

PRACTICAL DIETETICS. By Professor F. de Chaumont, M.D.

CHEMISTRY OF BREAD-MAKING. By Professor Charles Graham, D.Sc.

SCIENCE OF COOKERY. By Mattieu W. Williams, F.C.S.

PURE MILK. By G. W. Wigner, F.I.C., F.C.S.

THE ENGLISH DAIRY. By Professor J. P. Sheldon, F.C.S.

THE DANISH DAIRY. By Alexander Mariboe.

DAIRY MANAGEMENT. By Miss Marian Smithard.

ÆSTHETIC USE OF WINE. By John L. W. Thudichum, M.D., F.R.C.P.

INDEX TO VOLUME.

Price 7s. 6d. per Volume.

GENERAL HYGIENE.

WITH PREFACE BY CAPTAIN DOUGLAS GALTON, C.B., F.R.S.

VOLUME X. (*Published.*)

HANDBOOKS.

- ATHLETICS, OR PHYSICAL EXERCISE AND RECREATION. Part I. By Rev. Edmond Warre, M.A. *Illustrated.*
- ATHLETICS. Part II. By Hon. Edward Lyttelton, M.A., and Gerard F. Cobb, M.A.
- DRESS AND ITS RELATION TO HEALTH AND CLIMATE. By E. W. Godwin, F.S.A. *Illustrated.*
- FERMENTATION. By Dr. C. Duclaux, Professor of Biological Chemistry at the Sorbonne. *Illustrated.*
- PUBLIC HEALTH LABORATORY WORK. By W. Watson Cheyne, F.R.C.S., and W. H. Corfield, M.A., M.D., F.R.C.P. With Catalogue as Appendix.
- LONDON WATER SUPPLY. By Colonel Sir Francis Bolton, C.E.
- INDEX TO VOLUME.

VOLUME XI. (*Published.*)

CONFERENCES.

- MEDICAL SOCIETY OF LONDON AND NATIONAL HEALTH SOCIETY.—Sir Joseph Fayrer, M.D., F.R.S., Chairman; A. Pearce Gould, Secretary. Address: 11, Chandos Street, Cavendish Square, W.
  Dietaries—Duties of School Managers in relation to Epidemics—Preventive Treatment of Epidemics in Public and High Schools—Grammar and High Schools, their Construction and Arrangement—School Dormitories—Effects of Posture in Schools—Gymnastics in Schools—Gymnastics *Ferienkolonien*—The Health and Physical Development of Idiots as compared with mentally sound children.
- ROYAL METEOROLOGICAL SOCIETY.—R. H. Scott, President; William Marriott, Assistant Secretary. Address: 30, Great George Street, S.W.
  Some relations of Meteorological Phenomena to Health—English Climatological Stations.—Cumulative Temperatures, &c., as shown on the Diagrams exhibited by the Meteorological Office in the International Health Exhibition.—Some occasional Winds and their Influence on Health.—The Equinoctial Gales—Do they occur in the British Isles?
- ASSOCIATION FOR THE ORAL INSTRUCTION OF THE DEAF AND DUMB.—The Earl Granville, K.G., President; A. H. Moses, Hon. Secretary. Address: 11, Fitzroy Square, W. Subject: Oral Instruction of the Deaf and Dumb.
  On the Oral Instruction of the Deaf and Dumb. On the Education of Incurably Deaf Children
- SOCIETY OF TELEGRAPH ENGINEERS AND ELECTRICIANS.—Professor W. Grylls Adams, F.R.S., President; F. H. Webb, Secretary. Address: 4, The Sanctuary, Westminster, S.W.
  Electric Lighting in relation to Health.—Physiological bearing of Electricity in relation to Health.
- EPIDEMIOLOGICAL SOCIETY OF LONDON.—N. Chevers, M.D., C.I.E., President. Address: University College, Gower Street, W.C.
  Health in India—Change of Type in Epidemic Disease—Leprosy in India, and the best means of preventing its increase.
- INDEX TO VOLUME.

VOLUME XII. (*Published.*)

LECTURES.

- PARASITES OF MEAT AND FOOD (TWO LECTURES). By T. Spencer Cobbold, M.D., F.R.S.
- CANDLES. By Leopold Field.
- SOAP. By Charles F. Cross.
- HISTORY OF ENGLISH DRESS. By Hon. Lewis S. Wingfield.
- CHILDREN'S DRESS. By Miss Ada S. Ballin.
- TEXTILES GENERALLY. By William Morris.
- PHYSICAL EXERCISES FOR GIRLS. By Miss M. A. Chreiman.
- OLD AND MODERN POISON LORE. By A. Wynter Blyth, M.R.C.S.
- INDEX TO VOLUME.

VOLUME XIII.

OFFICIAL CATALOGUE. | JURY AWARDS.

WILLIAM CLOWES & SONS, LIMITED,
OFFICIAL PRINTERS AND PUBLISHERS TO THE EXECUTIVE COUNCIL,
13, CHARING CROSS, LONDON, S.C.

A

CATALOGUE

OF THE

OFFICIAL PUBLICATIONS

ISSUED BY THE EXECUTIVE COMMITTEE

OF THE

INTERNATIONAL FISHERIES EXHIBITION.

The exhaustive range comprised by the Handbooks and Prize Essays, which are by writers of great eminence and authority, and the comprehensive nature of the Papers which emanated from the various Conferences, combine to render this Series an exceptionally instructive and condensed Library of Reference on all questions appertaining to Fish, Fishing Appliances, and the Fishing Industries of all Countries, brought down to the date of the International Fisheries Exhibition of 1883.

LONDON:
WILLIAM CLOWES AND SONS, LIMITED,
OFFICIAL PRINTERS AND PUBLISHERS TO THE EXECUTIVE COMMITTEE,
13 CHARING CROSS, S.W.
1884.

A

CATALOGUE

OF THE

FISHERIES EXHIBITION LITERATURE

PUBLISHED BY

WM. CLOWES & SONS, LIMITED, 13, Charing Cross, S.W.

THE INTERNATIONAL FISHERIES EXHIBITION LITERATURE.

Complete in 14 Vols., each fully indexed. Demy 8vo. cloth. Price £6 6s.

The Fourteen Volumes, as above, comprise the whole of the IMPORTANT LITERARY OUTCOME of the Fisheries Exhibition, which is ssued in a collected form with copious Indexes, &c., by desire of the Executive Committee.

Any of the various divisions of this work may be obtained separately, at the following prices :—

	£	s.	d.
THE HANDBOOKS. Forming VOLS. I. to III. ..	1	11	6
THE CONFERENCE PAPERS. Forming VOLS. IV. to VII.	2	2	0
THE PRIZE ESSAYS. Forming VOLS. VIII. to XI. ..	2	2	0
THE OFFICIAL CATALOGUE AND JURY AWARDS. Forming VOL. XII. ..	0	10	[illegible]
THE OFFICIAL REPORT. Forming VOL. XIII. ..	0	10	6
THE ANALYTICAL INDEX. Forming VOL. XIV. ..	0	10	6

A Complete List, showing the contents of each of these volumes, will be found in the following pages, and single copies of any of the Handbooks, Conference Papers, or Prize Essays, may still be obtained of the Publishers at the prices affixed, although the volumes of each division *cannot be sold separately*.

THE FISHERIES LITERATURE—VOL. IV.

Conference Papers—Part I.

CONTENTS:—

INAUGURAL ADDRESS BY PROFESSOR HUXLEY, P.R.S. *6d.*

NOTES ON THE SEA FISHERIES AND FISHING POPULATION OF THE UNITED KINGDOM. By Vice-Admiral H.R.H. the Duke of Edinburgh, K.G. *1s.*

PRINCIPLES OF FISHERY LEGISLATION. By Right Hon. G. Shaw-Lefevre, M.P. *6d.*

FISH TRANSPORT AND FISH MARKETS. By His Excellency Spencer Walpole, Lieut.-Governor of the Isle of Man. *6d.*

THE ECONOMIC CONDITION OF FISHERMEN. By Professor Leone Levi, F.S.A., F.S.S., F.R.G.S., &c. *6d.*

A NATIONAL FISHERIES SOCIETY. By C. E. Fryer. *6d.*

RIVER POLLUTION BY REFUSE FROM MANUFACTORIES AND MINES; TOGETHER WITH SOME REMEDIES PROPOSED. By V. B. Barrington-Kennett, M.A., LL.M. *6d.*

PRACTICAL FISHERMEN'S CONGRESS. Under the Presidency of Mr. Edward Birkbeck, M.P. *6d.*

SCIENTIFIC RESULTS OF THE EXHIBITION. By E. Ray-Lankester, M.A., F.R.S., F.L.S., F.Z.S., &c. *6d.*

THE FISHERIES LITERATURE—VOL. V.

Conference Papers—Part II.

CONTENTS:—

FISHERY INDUSTRIES OF THE UNITED STATES. By Professor G. Brown Goode, M.A., &c. *6d.*

OYSTER CULTURE AND OYSTER FISHERIES IN THE NETHERLANDS. By Professor Hubrecht. *6d.*

THE FISHERIES OF CANADA. By Louis Z. Joncas. *6d.*

THE FISHERIES OF CHINA. By J. D. Duncan Campbell, Commissioner for China. *6d.*

A SKETCH OF THE FISHERIES OF JAPAN. By Narinori Okoshi, Member of the Japanese Consulate in London. *6d.*

NEWFOUNDLAND: ITS FISHERIES AND GENERAL RESOURCES. By the Hon. Sir Ambrose Shea, K.C.M.G., Commissioner for Newfoundland. *6d.*

THE SWEDISH FISHERIES. By Professor F. A. Smitt, Royal Commissioner for Sweden to the International Fisheries Exhibition. *6d.*

NOTES ON THE FISH SUPPLY OF NORWAY. By Frederik M. Wallem, Executive Commissioner for Norway to the International Fisheries Exhibition. *6d.*

NOTES ON THE FOOD FISHES AND EDIBLE MOLLUSCA OF NEW SOUTH WALES, Etc. By E. P. Ramsay, Commissioner for New South Wales. *6d.*

THE FISHERIES OF SPAIN. By Lieut.-Col. F. G. Solá, Executive Commissioner for Spain to the International Fisheries Exhibition. *6d.*

THE FISHERIES OF THE BAHAMAS. By Augustus J. Adderley, Commissioner for the Bahamas to the International Fisheries Exhibition. *6d.*

WEST AFRICAN FISHERIES, WITH PARTICULAR REFERENCE TO THE GOLD COAST COLONY. By Captain C. A. Moloney, C.M.G. *6d.*

THE FISHERIES LITERATURE—VOL. VIII.

PRIZE ESSAYS—PART I.

CONTENTS:—

THE COMMERCIAL SEA FISHES OF GREAT BRITAIN. By F. Day, F.L.S., F.Z.S. 5*s.*

THE EFFECT OF THE EXISTING NATIONAL AND INTERNATIONAL LAWS FOR THE REGULATION AND PROTECTION OF DEEP SEA FISHERIES, ETC. By C. W. Morris. 3*s.*

SALMON LEGISLATION IN SCOTLAND, ETC. By J. M. Leith. 1*s.* 6*d.*

THE FISHERIES LITERATURE—VOL. IX.

PRIZE ESSAYS—PART II.

CONTENTS:—

IMPROVED FISHERY HARBOUR ACCOMMODATION FOR GREAT BRITAIN AND IRELAND. By J. C. Wilcocks. 2*s.*

THE BEST SYSTEM OF LIFE INSURANCE FOR FISHERMEN, ETC. By J. W. de Caux. 1*s.*

THE RELATIONS OF THE STATE WITH FISHERMEN AND FISHERIES, ETC. By C. E. Fryer. 1*s.* 6*d.*

THE RELATIONS OF THE STATE WITH FISHERMEN AND FISHERIES, ETC. By F. J. Talfourd Chater. 1*s.* 6*d.*

THE HISTORY OF DUTCH SEA FISHERIES, ETC. By A. Beaujon. 4*s.* 6*d.*

THE FISHERIES LITERATURE—VOL. X.

PRIZE ESSAYS—PART III.

CONTENTS:—

THE NATURAL HISTORY OF COMMERCIAL SEA FISHES OF GREAT BRITAIN AND IRELAND, ETC. By Rev. W. Houghton, M.A., F.L.S. 7*s.*

IMPROVED FACILITIES FOR THE CAPTURE, ECONOMIC TRANSMISSION, AND DISTRIBUTION OF SEA FISHES. By H. P. Blake. 1*s.* 6*d.*

A CENTRAL WHOLESALE FISH MARKET FOR LONDON. By J. J. Cayley and H. H. Bridgman, F.R.I.B.A. 5*s.*

THE BEST APPLIANCES AND METHODS OF BREAKING THE FORCE OF THE SEA AT THE ENTRANCE TO HARBOURS AND ELSEWHERE. By W. A. Smith. 1*s.*